UNIVERSAL
LIBRARY

OU_156959

UNIVERSAL
LIBRARY

OSMANIA UNIVERSITY LIBRARY

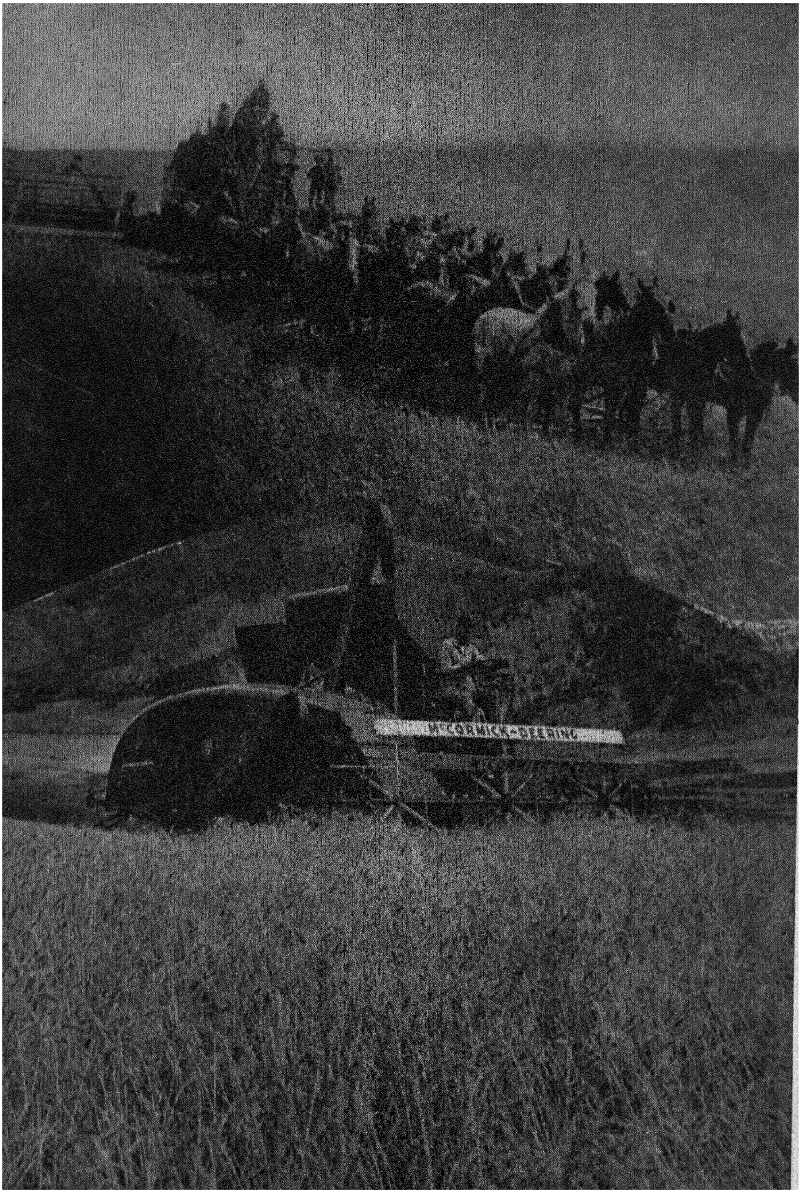
Call No. 631.1 / F73F. Accession No. G 8638

Author Forster, G. W.

Title Farm organisation & management. 1950.

This book should be returned on or before the date last marked below.

FARM ORGANIZATION
AND MANAGEMENT



Courtesy of Bureau of Agr. Econ.
and International Harvester

Time Marches On.

FARM ORGANIZATION AND MANAGEMENT

by

G. W. FORSTER, Ph.D.

PROFESSOR OF AGRICULTURAL ECONOMICS, NORTH CAROLINA STATE
COLLEGE OF AGRICULTURE AND ENGINEERING, UNIVERSITY OF NORTH
CAROLINA

Revised Edition

156959

NEW YORK
PRENTICE-HALL, INC.

COPYRIGHT, 1938, 1946
PRENTICE-HALL, INC.
70 FIFTH AVENUE, NEW YORK

ALL RIGHTS RESERVED. NO PART OF THIS BOOK MAY BE REPRODUCED IN ANY FORM, BY MIMEOGRAPH OR ANY OTHER MEANS, WITHOUT PERMISSION IN WRITING FROM THE PUBLISHERS.

First Printing ....October 1938
Second Printing ....January 1940
Third Printing ....April 1941

REVISED EDITION
First Printing ....August 1946
Second Printing ....May 1947
Third Printing ....February 1949
Fourth Printing ....March 1950

PRINTED IN THE UNITED STATES OF AMERICA

To

HENRY C. TAYLOR

TEACHER, FRIEND, AND COWORKER
THIS BOOK IS AFFECTIONATELY DEDICATED

Preface to Revised Edition

In revising this book, the general scheme and purpose of the original edition have been maintained. The experience of the author and others who have used it as a text or as a reference indicates, however, that a few changes are clearly desirable. In addition to bringing statistics up-to-date where this appears advisable, certain additions have been made in the subject matter. Two chapters on farm accounting, omitted from the first edition, have been added. This addition has been made in response to those who have used the book as a text continuously since its publication in 1938. Significant additions have been made in the case of a few chapters, especially Chapter XVII, dealing with the selection and acquisition of farm power. The chapters on management have been enriched by the data now available on this important subject as a result of the excellent investigations made under the able leadership of E. C. Young of Purdue University. Numerous minor changes have been made, partly to correct errors, but more particularly to reduce obvious duplication of ideas and subject matter.

It is a pleasure to acknowledge the assistance of a number of individuals who have read the original and have made suggestions as to how it might be improved. The author is especially pleased to acknowledge the assistance given to him by his colleagues, R. E. L. Greene, H. Brooks James, and Francis E. McVay, and his former associates, Gunnar Lange and Victor B. Sullam. As with the former edition, credit must be given to Clara L. Gilbert, Margaret K. Fleming, and my wife, Florence P. Forster, for aid in typing and editing the manuscript.

G. W. Forster

Preface to First Edition

In the following pages an attempt is made to integrate general economic principles, as they apply to farm management, with sound farm practices. This is somewhat of a departure from the normal procedure in the preparation of a textbook on farm management. Heretofore emphasis has been placed either on farm practices or on economic theory, with the result that the textbooks, in the main, have not been entirely satisfactory for teaching purposes. The earlier writers emphasized the practical aspects of the subject to almost the entire neglect of the theoretical discussion or analysis. On the other hand, the more recent writers have approached the subject from the standpoint of economic analysis but have failed to discuss, adequately, sound farm practices. The present text is by no means free from defects and is not completely integrated. Nevertheless, an effort has been made to weave these two elements together in such a way as to enable the student to get the importance of each.

The text may be roughly divided into two parts; the first part deals with the organization of the farm, and the second part with its management. It is, of course, often difficult to differentiate these two, but for the purpose of presentation of the subject, this division has been adopted. Several subjects normally included in a text of this type have been omitted. This is especially true of such subjects as types of farming and farm records and accounts. The first subject has been omitted because it is one which deals not so much with the organization of farms as with the explanation of the reasons for different types of organization in different geographical areas and, therefore, belongs more particularly to the general subject of agricultural economics. The second subject has been omitted because of the fact that in most institutions a separate course has been developed to cover, in an adequate fashion, this somewhat complex and intricate subject. In brief, the purpose has been to stick as closely as possible to those subjects which deal primarily with the organization and management of the individual farm.

In the preparation of this text the author has had the advantage of actual farm experience in several parts of Canada and the United States and fifteen years of teaching and research experience. In addition, he has had the advantage of studying agriculture in continental Europe. It is not necessary, of course, to state that dependence has been placed upon the rather voluminous information that has been published on the subject of farm management in this and other countries. Many of the ideas expressed are in no sense new, although perhaps a new approach has been made to the subject. The author's experience as assistant to Dr. Henry C. Taylor in the formative years of the Bureau of Agricultural Economics has helped him in understanding the problem and appreciating the views of leaders in this field, particularly those of Henry C. Taylor, G. F. Warren, W. J. Spillman, Andrew Bost, and E. G. Nourse, to mention the pioneers. Helpful suggestions have also been obtained from the writings of and personal association with such younger men as L. C. Gray, J. D. Black, H. R. Tolley, G. A. Pond, F. F. Elliott, J. W. Tapp, J. B. Hutson, H. C. M. Case, I. G. Davis, C. L. Holmes, H. W. Hawthorne, H. M. Dixon, and other talented and brilliant investigators.

Acknowledgment is due a number of individuals who read the manuscript and made helpful suggestions and criticisms: C. J. Bradley of the University of Kentucky has gone over the text carefully and has been especially helpful in the preparation of many of the chapters; I. G. Davis of Storrs, Connecticut, has been kind enough to read the manuscript with care and has given the author valuable assistance; Paul E. Eke of Idaho University has used the text in mimeograph form and has been especially helpful in the discussion of certain chapters, more particularly those relating to farm organization. The author has had the help and encouragement of his colleagues, J. G. Knapp, R. H. Rogers, R. E. L. Greene, and E. M. Bernstein. A group of graduate students, W. C. Welden, D. H. McVey, L. R. Paramore, B. B. Kendrick, and J. E. Hull, have assisted in the preparation of the text to the extent of aiding the author in assembling material and making, in some instances, preliminary drafts of certain chapters. Finally, the author is indebted to Clara L. Gilbert, Margaret K. Fleming, and Virginia F. Lynn for patient labor associated with the typing and editing of the manuscript and the preparation of charts.

G. W. Forster

Contents

CHAPTER PAGE

I. THE NATURE OF MODERN FARMING 1
  1. The Concept of the Farm 2
  2. The Self-Sufficiency of the Modern Farm 6
  3. The Function of Management and Ownership in Farming 9
  4. Farming—An Industry of Small Independent Units 10
  5. Farm Products Not Easily Standardized 10
  6. Limitation of the Farmer's Control Over Production 11
  7. Agriculture Subject to Great Risks 12
  8. Financing of Agricultural Production a Difficult Task 14
  9. Professional Training of Farm Operators Limited 14
  10. Significance of the Characteristics 15

II. THE NATURE OF FARM MANAGEMENT 19
  1. Various Concepts of Farm Management . 19
  2. Farm Management and the Technical Sciences 22
  3. Farm Management and the Social Sciences 25
  4. Definition of Farm Management 26

III. THE DEVELOPMENT OF FARM MANAGEMENT 28
  1. The Development in the United States . . . 28
  2. The Development in European Countries 37

IV. THE PROBLEMS OF FARM ORGANIZATION 50
  1. Organization Defined and Described . . . 50
  2. The Selection of the Lines of Production . . 52

CHAPTER PAGE
IV. THE PROBLEMS OF FARM ORGANIZATION (*Cont.*)
3. The Combination of the Factors of Production . . . 60
4. Market Connections and Information . . . 63
5. The System of Records and Accounts . . . 63

V. SELECTION AND COMBINATION OF FARM ENTERPRISES—GENERAL PRINCIPLES . . . 66
1. Methods of Selecting Enterprises . . . 66
2. The Problem of Allocating Farm Resources . . . 72
3. Rules for the Allocation of Farm Resources to Various Farm Enterprises . . . 76

VI. SELECTION AND COMBINATION OF FARM ENTERPRISES—METHOD OF SUBSTITUTION . . . 81
1. The Method of Substitution . . . 81
2. The Present Organization of the Farm . . . 84
3. Suggested Changes . . . 88
Plan Number 1 . . . 88
Plan Number 2 . . . 91
4. The Theory of Equi-Marginal Returns and the Method of Substitution . . . 95

VII. SELECTION AND COMBINATION OF FARM ENTERPRISES—METHOD OF DIRECT COMPARISON . . . 97
1. Basic Information Needed . . . 98
2. The Method Used in Collecting Necessary Information . . . 99
3. Method of Analysis . . . 100
4. Criticisms of the Method . . . 110

VIII. THE STANDARD COMBINATION OF FARM ENTERPRISES . . . 114
1. The Kind of Information Needed . . . 114
2. The Analysis of Data . . . 115
3. The Development of the Standards . . . 117
4. The Usefulness of Standards . . . 124

CHAPTER PAGE
IX. USING THE STANDARD SYSTEMS 127
1. A Standard Forty-Acre Farm 127
2. The Analysis of an Actual Farm 139
3. The Reorganization of Farm "A" 142
4. Criticism of the Standard Method 145

X. SPECIALIZED AND DIVERSIFIED FARMING 151
1. Diversification and Specialization Defined and Described 151
2. The Law of Comparative Advantage 152
3. Reasons for Specialization 154
4. Reasons for Diversification 158
5. Diversification and Returns 161

XI. UNITS OF MEASUREMENT 167
1. Measuring the Size of the Business 167
2. Measuring the Factors of Production 170
3. Measuring Diversification 179
4. Measuring Productiveness 180
5. Measuring Capacity and Efficiency 184
6. Measuring the Success of the Farm Business 185
7. Criticism of Measures of Success 189

XII. THE ECONOMICS OF FARM PRACTICES 195
1. Types of Farm Practices 195
2. Some Causes for Variation in Farm Practices 196
3. The Scientific Study of Farm Practices .. 197
4. Controlled Experiments 198
5. Practical Experimentation 199
6. The Law of Diminishing Productivity ... 203
7. Determining the Most Profitable Combination of Inputs 204
8. Conclusions 213

XIII. THE ECONOMICS OF FARM PRACTICES *(Continued)* 215
1. The Relation of Specific Tasks to Income 217
2. The Effect of Methods on Utilization of Labor 219

CHAPTER PAGE

XIII. The Economics of Farm Practices (*Continued*)
- 3. The Effects of Methods on the Utilization of Capital ... 222
- 4. The Relation of Methods to the Use of Land ... 225
- 5. Time or Timeliness as Related to Farm Practices ... 226

XIV. Farm Layout ... 233
- 1. Factors Affecting the Farm Layout ... 233
- 2. The Ideal Farm Layout ... 235
- 3. The Effect of Farm Layout on the Use of Factors of Production ... 237
- 4. Planning the Farm Layout ... 243
- 5. Developing a Good Farm Layout ... 244

XV. Size of the Farm ... 250
- 1. Measuring the Size of the Farm ... 251
- 2. The Relation Between Area and Net Returns ... 253
- 3. Economy in the Use of the Factors of Production ... 256
- 4. Economy in the Use of Products ... 265
- 5. Reduction of Risk ... 267
- 6. Advantages in Buying and Selling ... 268
- 7. Economies in Financing ... 269
- 8. Conclusions on the Size of the Farm ... 270

XVI. Selection and Acquisition of the Farm ... 272
- 1. Some Economic Factors Affecting the Acquisition of a Farm ... 273
- 2. Some Important Physical Factors Affecting the Choice of a Farm ... 277
- 3. Personal Considerations Affecting Purchase or Rental ... 287
- 4. Farm Appraisal ... 288
- 5. Legal Aspects of Buying a Farm ... 292
- 6. The Size of Farm to Acquire ... 295

XVII. Selection of Farm Machinery and Power ... 297
- 1. Factors Affecting the Selection of Machinery ... 297

CHAPTER PAGE

XVII. SELECTION OF FARM MACHINERY AND POWER (*Cont.*)
2. How to Select a Machine 299
3. Selecting the Type of Farm Power 305

XVIII. THE DIFFERENTIAL NATURE OF MANAGEMENT 318
1. The Functions of Management 318
2. The Farmer as a Manager 321
3. Management in Farming and in Industrial Enterprises Compared 323
4. Scientific Management 324

XIX. THE MANAGEMENT OF LABOR AND WORKING CAPITAL 328
1. The Selection of Labor 329
2. The Assignment of Tasks and the Training and Supervision of Labor . 330
3. Developing Initiative, Good Will, Coöperation, and Respect 335
4. Planning Day-to-Day Utilization of Labor 336
5. Making Day-to-Day Adjustments . 339
6. Providing Social Life 340
7. Working Capital Defined 341
8. Planning the Use of Working Capital for the Year 342
9. Adjustments in Working Capital . . . 342
10. Supervising Working Capital . . . 343
11. Purchasing Supplies and Materials . 345

XX. NEW FORMS OF MANAGEMENT IN AGRICULTURE 350
1. Corporation Farming 350
2. Chain Farming 354
3. Group Farming 355
4. Professional Farm Management Service . . 358
5. General Appraisal of the New Forms of Farm Management 359

CHAPTER PAGE
XXI. ECONOMIC REPORTS AS AIDS TO MANAGEMENT . . . 362
1. The Nature of Available Reports . . . 363
2. Intentions-to-Plant Reports . . . 367
3. The Pig Crop Report . . . 368
4. Outlook Reports . . . 368
5. Accuracy of the Reports . . . 371
6. How Reports May Be Used . . . 373

XXII. FARM RECORDS . . . 376
1. Records and Accounts Defined and Described . . . 376
2. Kinds of Farm Records . . . 377
3. Summary—the Function of Records and Accounts . . . 391

XXIII. FARM ACCOUNTS . . . 394
1. The Nature of Simple Farm Accounts . . . 394
2. A Set of Simple Farm Accounts . . . 402
3. Keeping Simple Farm Accounts by Columnar Method . . . 420
4. An Analysis of the Results . . . 426

XXIV. THE SHARE RENTAL CONTRACT . . . 430
1. Conventional Types of Rental Contracts 430
2. Factors Governing Type of Rental Contracts . . . 433
3. The Making of an Equitable Contract . 434
4. The Nature and Preparation of a Written Lease . . . 440
5. Advantages and Disadvantages of the Written Lease . . . 452

XXV. THE CASH RENTAL CONTRACT . . . 456
1. Methods of Determining When Cash Rents Are Fair and Reasonable . . . 457

XXVI. CREDIT FOR FARM OPERATION . . . 464
1. Principles Involved in the Use of Farm Credit . . . 464

CHAPTER PAGE

XXVI. CREDIT FOR FARM OPERATION (*Cont.*)

2. The Basis of Farm Credit 467
3. Types of Credit Needed 468
4. Sources of Farm Credit 469
5. The Cost of Credit 474

INDEX 477

CHAPTER I

The Nature of Modern Farming

FROM the beginning of the Colonial period to the close of the Civil War, American farmers produced primarily for their own needs. To be sure, in some sections products were grown for sale. But with the exception of a few commodities, notably cotton and tobacco, no large surpluses were available either for the domestic or for the foreign markets. Between the close of the Civil War and the beginning of the twentieth century, however, the use of machinery in the production of farm crops became so general and the results of scientific research inaugurated about 1862 became so effective that large quantities of farm products were flooding both the domestic and the foreign markets. The present century, although experiencing a decline in agricultural exports, has witnessed an increase in the production of farm commodities intended primarily for the market. In less than three fourths of a century agriculture has been changed from a simple, self-contained economy to a commercial economy.

This change in agriculture from a purely self-sufficing economy to a commercial economy has been so pronounced that many writers have characterized modern farming as capitalistic—similar in its essential features to urban industries. This analogy is faulty. It is true that farming has many of the characteristics of a capitalistic enterprise, but, in other respects, it differs markedly from the bona fide urban enterprise. It is self-sufficient to a large extent with respect to food, fuel, labor, and power. Large capital investments and minute division of labor, which characterize many urban enterprises, are uncommon in agriculture, if indeed not entirely absent. Then, too, in many urban enterprises the functions of ownership and management have been separated. In farming, on the other hand, these functions are combined, as a rule, in the farm operator. The unit of organization in urban enterprises tends to be large; in farming the unit of organization is small. In these and other important ways farming is different from the purely capitalistic enterprise. These differences, as to both kind and degree, warrant the designation of agriculture as a *quasi-capitalistic* enterprise. In short, agriculture partakes of the nature of both commercial and self-sufficient economies. It is the purpose of this chapter to develop this concept and to indicate its significance in the organization and operation of the farm.

1. The Concept of the Farm [1]

First, however, it will be necessary to define a farm. According to common American usage, a *farm* consists of all land, with appropriate equipment, that is operated by an individual, partnership, or corporation for the production of agricultural products. When two or more distinct tracts are operated from a common center, each tract is considered a farm. In comparison with this common usage, the census defines a farm as: "... all the land which is directly farmed by one person either by his own labor alone or with the assistance of members of his household or hired employees. The land operated by a partnership is also a farm. A farm may consist of a single tract of land, or a number of separate tracts, and these several tracts may be held under different tenures, as where one tract is owned by the farmer and other tracts are rented by him. When a landowner has one or more tenants, croppers, or managers, the land operated by each is considered a 'farm'." [2]

In some states, more especially in the West, the word

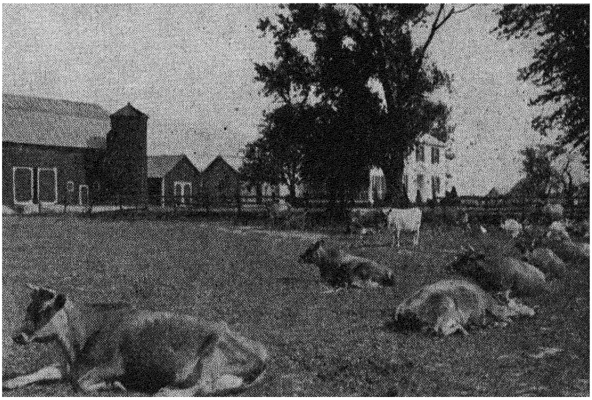
---

[1] In part adapted from an article on "Farm" in *The Encyclopedia of Social Science,* Vol. 6, p. 102. New York: Macmillan.

[2] *U. S. Census of Agriculture,* 1925, Part III, p. vii.

ranch is used almost exclusively for *farm.* A poultryman does not operate a chicken farm, but a chicken ranch; a fruit grower does not operate a fruit farm, but a fruit ranch. A ranch in the strict meaning of the word, however, is a range or large area, not necessarily enclosed, used for raising of livestock by grazing.

Again, a *plantation* has certain characteristics which serve to distinguish it from a farm as commonly understood or as defined by the census. A plantation is, according to Brannen, "a unified agricultural organization of considerable size under one management, of practically a continuous tract of land, operated as a single unit with respect to the methods of control of labor and products, all or a part of which may be worked by wage hands, or all or a part of which may be sub-divided and let to tenants."[3]



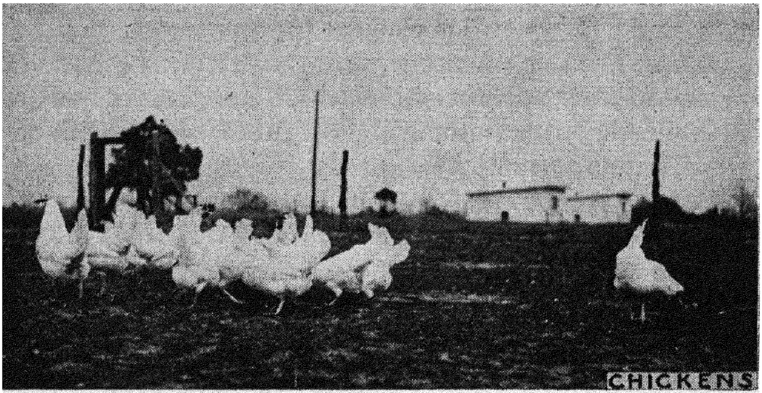
Courtesy of N. C. State Dept. of Agr.

Fig. 1. Modern farming is a unique combination of a business enterprise and a mode of life.

Writers have frequently used the term *family farm* in an attempt to characterize the typical American farm. This concept, however, has no precise meaning. To some it connotes the size of farm which will maintain the farmer and his family in accordance with the existing standard of liv-

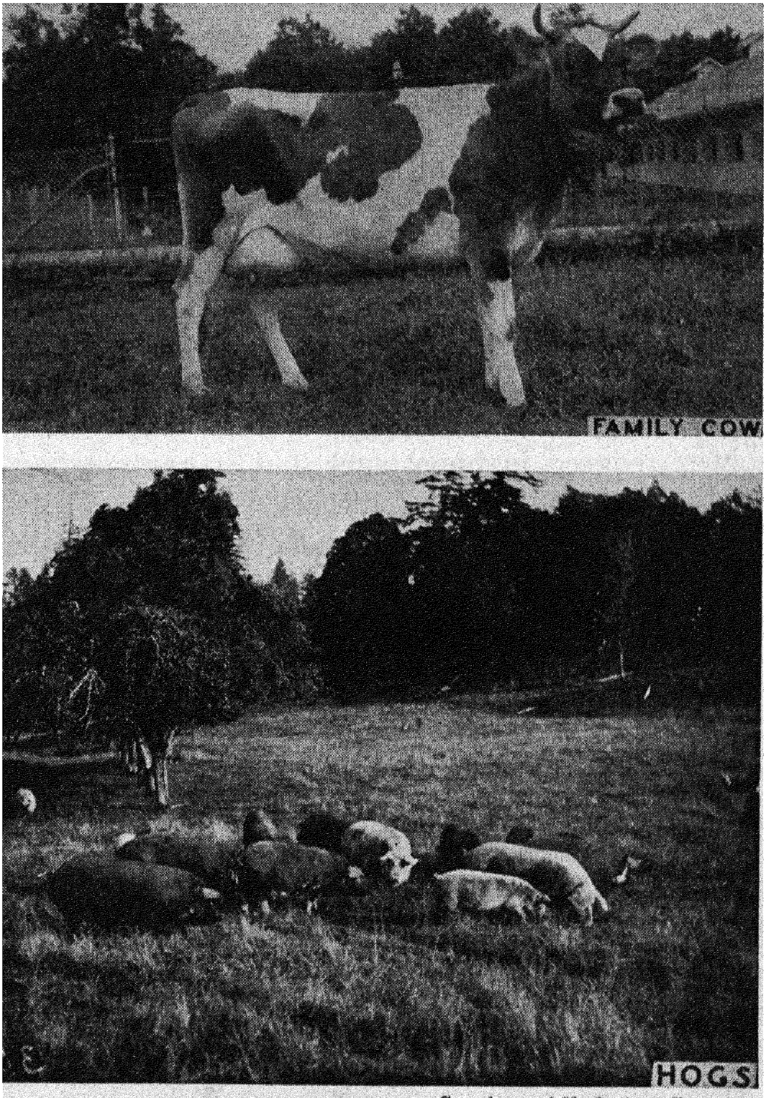
---

[3] Brannen, C. O., "Relationship of Land Tenure to Plantation Organization," p. 9.


CHICKENS

FARM GARDEN SUPPLIES

WOOD



Courtesy of N. C. Agr. Exp. Sta.

Fig. 2. Modern farming tends to be self-sufficient with respect to food and fuel.

ing; to others it means that size of farm which will give full employment at productive labor to the farm family. To still others the family farm is one of such size that the family does most of the work, with some hired labor. It is recognized that the size of the family farm will vary according to the kind of people, standard of living, type of farming, and physical conditions. In some areas, notably on irrigated projects, the family farm may be a farm of very few acres; whereas, in other localities, such as the Corn Belt, it may be as large as 160 to 320 acres. In the semiarid regions, it may involve several sections of land.

2. The Self-Sufficiency of the Modern Farm[4]

In the evolution of farming the element of self-sufficiency has been reduced in importance, but it has not been removed. Funk in 1913 showed that, in the case of 950 farm families widely distributed throughout the United States, 66 per cent of the food, fuel, and shelter was obtained from the farm.[5] Kirkpatrick in a similar study in 1926 found that, for 2,886 farm families distributed in eleven states, 42.8 per cent of all goods used by the farm family was supplied by the farm.[6] Of the food, fuel, and shelter, 72.4 per cent was furnished by the farm. Other studies, especially by Hawthorne, supply additional evidence that farming is still considerably self-sufficient in food, fuel, and shelter.[7]

The modern farm is not only self-sufficient with respect to food, fuel, and shelter, but a large part of the labor used on the farm is supplied by the farmer or his household. The "unpaid family labor" and the labor of the operator

---

[4] Data in this chapter from the *Fifteenth Census* have been retained. The following table compares changes from 1909 to 1939.

Year	*Labor*	*Fertilizer*	*Feed*	*Machinery*	*Livestock*	*Land and Buildings*
1909	$ 82	$ 18	$ 47	$199	$ 774	$ 5,471
1919 . . .	170	51	170	557	1,243	10,284
1929 . . .	152	43	146	525	964	7,614
1939	128	36	120	501	747	5,518

[5] Funk, "Value to Farm Families of Food, Fuel, and Use of House."

[6] Kirkpatrick, "The Farmer's Standard of Living."

[7] Hawthorne, "The Family Living from the Farm."

loom large in any study of the production of farm commodities. Hired labor is a relatively small item of expense. In 1920, although 22 per cent of all persons gainfully employed on the farm were hired laborers,[8] the average annual cash outlay for labor was $170 per farm, and only 42 per cent of all farms reported cash expenditures for labor. The corresponding figure for 1930 is $152. Of course, in some sections and on some farms in most sections of the United States, all or a large part of the labor is hired. But the typical farm is operated by the labor of the operator and of members of his family.

The modern farm is likewise, in part, self-sufficient with respect to seed, fertilizer, and feed. No accurate data are available as to the amount and the value of seed purchased by farmers, but it is well known that most farmers save their seed from the crops harvested. To a limited extent, farmers buy improved seed; and occasionally, when their crops are poor in quality, they may be forced to buy all or most of the seed used. In some sections, such as the early potato areas of the South, most, if not all, seed for certain crops may be purchased. The quantity of seed and plants actually bought by farmers, however, is small compared to the total amount used.

Although fertilizers are used more extensively now than at any period in the past, the farmer is not wholly dependent upon commercial fertilizers as a source of plant food. There are three other important sources: namely, stable manure, a by-product of livestock enterprises; green manure; and soil improvement crops, more especially the legumes. All of these are noncommercial in character; that is, they can be and are supplied by the farm. That the average farm is self-sufficient with respect to plant food is evident from the annual outlay for commercial fertilizers. According to the 1930 Census, farmers spent in 1929, $271,058,673 for fertilizer, or about $43 per farm. In 1924, as shown by the 1925 Census, the expenditure for fertilizer was $230,528,446, or $36 per farm; and the corresponding data for 1919 show a total expenditure of $326,399,800, or $51 per farm. These figures are somewhat misleading in that there are large areas, especially where tobacco, cotton, and market garden products are grown, where commercial fertilizers are used extensively. But, in the main, farmers are not dependent on commercial fertilizer for crop production and may, in many cases, get along without purchasing any plant food at all.

---

[8] U. S. Department of Commerce, *Fifteenth Census.*

The feed purchased for livestock in 1929 cost the farmers of the country $919,189,626, or $146 per farm.[9] The figures for 1924 were $750,444,560 and $117.77.[10] According to King, $6,550,000,000 worth of crops was fed to livestock in 1919.[11] If this figure is approximately correct, then farmers bought 17 per cent of their total feed. Or, conversely, 83 per cent of the total feed was raised on the farm. It has also been estimated that the value of all crops fed to livestock in 1929 was about $3,803,000,000, or about 75.8 per cent of the total feed used on the farm.[12]

To no small extent farmers raise their workstock and most of the feed for such stock. It thus happens that, generally speaking, the power used on the farm is supplied by the farm. It is, of course, true that tractors, stationary engines, windmills, and electric motors are now important sources of farm power. But, in spite of the great advance made in the adaptability of mechanical power, it has not supplanted work animals,[13] nor is it likely to. For many of the farm operations, animal power is the cheaper and the more satisfactory. As long as this continues to be true, much of the power will be furnished by the workstock belonging to the farm.

---

[9] U. S. Department of Commerce, *Fifteenth Census,* Vol. II, p. 52.

[10] *U. S. Census of Agriculture,* 1925, Part I, p. 16.

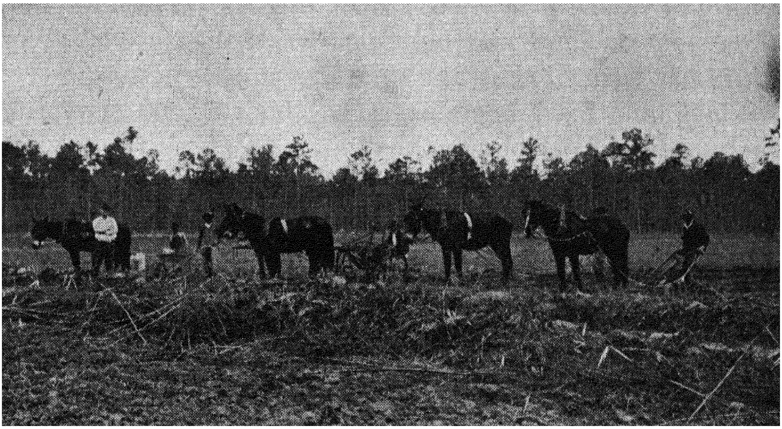
[11] King, *Income of the United States,* Part II, p. 51.

[12] Based on data published in *Farm Value, Gross Income, and Cost Income from Farm Production, 1929–30,* U.S.D.A., Preliminary Report, Oct., 1931.

[13] Kinsman, "An Appraisal of Farm Power on Farms in the United States."

3. The Function of Management and Ownership in Farming

Another important characteristic of modern farming is the association in one person of the functions of management and ownership. This association of the two functions is characteristic of early business enterprises. In former times, practically all types of industries were conducted by the individual who owned the business and controlled the operation of it. In modern times, in commercial and industrial establishments, the function of management is usually separated from ownership. That is to say, the owners or stockholders do not direct the details of the business but usually hire foremen, superintendents, and managers for this purpose. In support of this dual function of the farm operator, data from the Census of 1930 may be used. This source states that 56.7 per cent of the farmers owned the farms which they operated and less than 1 per cent of the farms were operated by hired managers. In the case of leased farms, there is a partial separation of the functions of management and ownership, but only about 18 per cent



Courtesy of N. C. Agr. Exp. Sta.

Fig. 3. Horses and mules are the principal source of farm power.

of the tenants operating farms are cash tenants. The bulk of the leased farms are operated by share tenants, who are to a large extent under the direct supervision of the owner or landlord.

4. Farming—An Industry of Small Independent Units

In farming, the unit of organization is small. In this respect farming is similar to the small retail trade enterprise and the local shop or neighborhood industries. In 1930 there were 6,288,648 farms, the average size of which was 157 acres. There was, of course, considerable variation in the size, but 80 per cent of all farms were 174 acres or less. The capital invested in implements and machinery in 1930 was $3,301,654,481, or $525 per farm. The livestock was valued at $5,794,113,926, or $921 per farm. The investment in land and buildings was $47,879,838,358, or $7,614 per farm. Thus, the total investment in machinery, livestock, and fixed assets averaged about $9,060 per farm. The number of persons ten years of age or over engaged in agriculture was approximately 10,500,000, or less than two persons per farm. The primary power used on the farms aggregated 47,420,000 horse power units, or 74 horse power per farm.

5. Farm Products Not Easily Standardized

Another distinguishing feature of farming is the great difficulty attending the standardization of farm products. It is true that farmers may, to a limited extent, determine the character of their products. For example, it is possible, by selecting and breeding, to change materially the character of plants and animals. As a result of experimentation great improvement has been made in the form and character of many farm products. But standardization by such means is obviously not as effective as standardization by machine methods and processes. By use of machines it is possible to turn out large quantities of articles identical as to shape, size, and quality. All that the farmer can do is to get the most uniform products possible by breeding, selection, and cultural methods, and then to sort or grade the products. This method of sorting and grading, when compared with the machine method, is expensive. To be graded economically, agricultural products must be assembled in large quantities. And, as the output on the average farm is small, volume can be obtained only through some form of coöperative effort. To organize a coöperative may be an easy task; however, when such an association is organized, it is difficult to manage it efficiently.

6. Limitation of the Farmer's Control Over Production

One of the well-organized elements of success in the management of any business enterprise is control of production. When production is not controlled or not controllable, serious maladjustments are likely to occur, as at times more products will be produced than can be sold profitably, and at other times not enough products are available when prices are high. Some businessmen avoid overproduction and underproduction by adjusting their production (both as to total amount to be produced and the rate) to anticipated demand. In fine, they estimate from available data the probable future prices and costs, and on these estimates they decide the amount of goods that can be produced profitably. Farmers, as a rule, do not do this; they react to prices at planting and breeding time. If the price of a specific product is high at planting time, the acreage will be increased; and, if prices are low, the acreage will be reduced. The farmer reacts in a similar way in reference to animal production. When prices of animals or animal products are high, farmers embark on an extensive program of expansion; and, when prices are low, they restrict their breeding operations. When the large production comes upon the market, the prices are depressed; when production is sufficiently curtailed, prices are high. The average farmer misses the market in practically every case. But, even if farmers could anticipate prices and base their production on anticipated prices, they do not have the same control over production as is normally exercised by the manufacturer. Weather is an important factor affecting agricultural production, and weather conditions cannot be accurately forecast. Farmers must plan their production program on normal weather conditions. If the weather is extremely favorable, overproduction may result; and, of course, on the other hand, if weather conditions are unfavorable, underproduction may result.

Industrial establishments often gain control over production through combination. That is, independent establishments producing the same or similar articles often merge their interests into one large corporation. With one large corporation, the control is centralized, and the production may be better adjusted to anticipated demands. Such a control of production usually results in a larger net profit than would be realized if each corporation operated independently. Control of production through combination, which is open to both manufacturing and commercial concerns, is not used by farmers. Farmers do not associate themselves in groups for the purpose of control of production. It is a fact that farmers form coöperative marketing associations, but the object is not the control of production. The object is to market their products efficiently. Any profits thus realized are reflected back to the individual producer. This increase in profits tends to stimulate the farmer to greater production, and this may mean lower prices. In other words, the board of directors of a coöperative marketing association does not exercise control over the production of the individual members. If agricultural production is to be controlled, it must be controlled by the individual farmer; and this, as has been noted, is a difficult thing to accomplish even under governmental supervision.

7. Agriculture Subject to Great Risks

Farming is constantly subjected to damage from excessive rainfall, drought, hail, floods, insect pests, and plant and animal diseases. To a marked degree, urban industries can protect themselves against weather conditions; and they are not subject, to any large extent, to insect pests and plant diseases. Furthermore, many risks peculiar to urban industries are insurable, but insurance companies have found it difficult to work out a plan which will give farmers adequate protection at a reasonable cost. As a matter of fact, farm insurance is confined largely to fire and hail insurance. There really is no such thing as general farm insurance.

The inability of the farmer to obtain protection has forced him to rely upon self-insurance. As a safeguard against extreme losses, he finds diversification of production the most effective. While diversification of this kind does not always prevent losses from plant and animal diseases, insect pests, and climate conditions, it does tend to reduce losses from these causes.

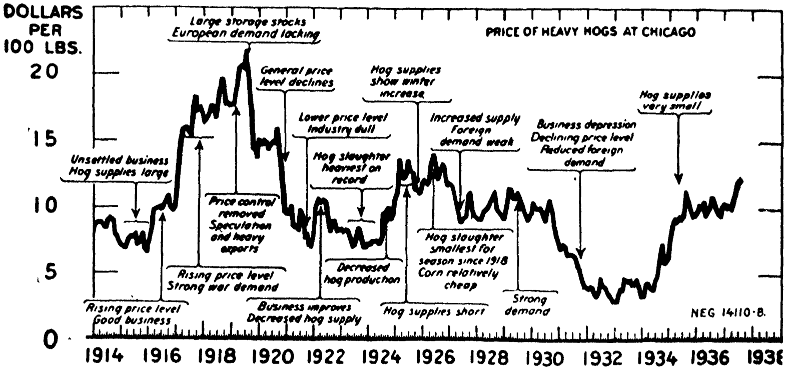


Illustration from Bu. Agr. Econ.

Fig. 4. Farming is subject to many risks, of which changes in the prices of farm products are significant.

Other means of avoiding losses have been developed. For example, plants have been bred that will mature within the usual period between killing frosts; others have been bred to resist drought and plant and insect diseases. These methods of adapting plants to conditions have often saved farmers from serious losses. In some instances, whole areas have been made prosperous following serious crop damage. Farmers also reduce losses by careful observation of weather conditions. By observing the normal occurrence of the last killing frost in the spring, and the first killing frost in the fall, farmers may adjust their farm operations so that damage from freezing will be minimized or eliminated. Losses because of seed sterility may be eliminated by testing seed before planting. However, when all of these various kinds of insurance are utilized, there still remains a considerable element of risk, and heavy losses occur annually.

8. Financing of Agricultural Production a Difficult Task

Because of the various hazards to which agriculture is subject, agricultural production is not easily financed. Credit based on crop production is hazardous, and, as a result, the interest rates are often high. In the case of livestock, credit must be extended over a period longer than a year, usually eighteen months to three years. Cattle, the basis of such security, may die, or they may be moved from place to place. For these reasons, the extension of credit on cattle, unless the farmer is well known to the creditor, is not readily obtained at reasonable costs. These difficulties do not apply to land. Land is fixed, and credit based on land may be easily obtained at reasonable costs. On the whole, however, even with the various facilities which have been recently provided by the Federal Government, the cost of agricultural credit remains high and is more expensive than is credit supplied to most urban enterprises.

9. Professional Training of Farm Operators Limited

Modern farming tends to differ markedly from urban industries in training required of the operator. Pioneer farming was a simple occupation. The essentials for success were good health, physical strength and dexterity, and ability to withstand for long periods of time physical hardships and isolation. Today the elements of success have changed somewhat. The general use of machinery in farming has relieved the farmer of some of the hard labor, but, even so, physical strength is still a prerequisite. The fact that the farmer must produce for the market and must judge to some extent market demands has sharpened his intellect. The process of commercialization in farming has not gone far enough, however, to make him an alert businessman. The ordinary farmer can still get along after a fashion without a great deal of education. A survey of 2,886 farmers in eleven states shows that the education of a large percentage of farmers was less than the twelfth grade.[14] These data and others which have been assembled indicate that the average farmer is acquainted with little more than the simple rudiments of knowledge. In recent years vocational education and extension work have added much to the farmer's knowledge of technical production; but his knowledge of the principles of business, as founded upon economics, accounting, statistics, and psychology, is still meager and often of the crudest sort.

10. Significance of the Characteristics

The influence of the characteristics of farming on the action of farmers has been emphasized, but special attention should be given to self-sufficiency. With respect to this element, modern farming stands in sharp contrast with the modern capitalistic enterprise. The latter is not to any large extent self-sufficing. The labor used is hired, and the equipment and material necessary for operation are purchased in the open market. In short, the modern urban capitalistic business has to meet its expenditures or obligations from day to day or from week to week, as these obligations, as a rule, cannot be postponed. In contrast, the farmer does not have to act in this way. The fact that he may defer payments helps to explain the peculiar action of farmers. He responds, as several studies have revealed, to present or past economic conditions, rather than to anticipated events. To illustrate, the cotton farmer has invariably reduced his acreage when the price of cotton at planting time was low, and increased his acreage when the price at planting time was high. This action has, in the main, reduced his income, because it has been a factor in causing overproduction of specific crops in some years and underproduction in other years. The self-sufficing character of modern farming is unquestionably the principal cause of this, and it is argued that if the farmer were compelled under all conditions and at all times to pay a competitive labor wage, to pay market and competitive rates for power and materials, he would be compelled to practice economy, to organize his business on a scientific basis, and to keep it adjusted to changing economic conditions. But since the farmer is not forced to do this, he is not alert either to short-time fluctuations in the market or to long-time trends in economic conditions which seriously affect his economic status.

---

[14] Kirkpatrick, *op. cit.*

Another explanation of this behavior of farmers is found in the relationship of fixed to variable costs. In farming, the fixed costs constitute a much larger proportion of the total costs than do the variable costs; that is, the cost of maintaining land, buildings, and equipment, together with the cost of labor supplied by the farmer and his family, usually constitutes a much larger proportion of the total cost than those costs, such as hired labor, seed, and fertilizer, which tend to vary directly with production. Hence, anticipated low prices may not result in any marked change in the farmer's production plans. The reason for this is obvious: The fixed costs will not be greatly affected by normal changes in production, so that the farmer stands to gain if the anticipated returns are greater than the direct or variable costs. Or to state it differently, any excess in returns over the variable cost may be applied to the overhead cost. It is because of this relationship between the fixed and variable costs that an anticipated rise in prices may be followed by an increase in farm output, but an anticipated low price may not bring about any material decrease in production. If the total cost should vary directly with production (that is, if all costs were variable costs), any anticipated change in price would immediately result in a corresponding change in production. However, since farm production costs are seldom, if ever, all variable, this kind of response does not occur. The farmer's response, therefore, to anticipated prices will depend on the ratio of his variable to fixed costs. Where the fixed costs constitute a large percentage of the total cost, the farmer will not change his production plans in response to the anticipated changes in prices, unless these prices are likely to be higher than normal. When anticipated prices are likely to be below normal, he may not decrease his output. A marked decrease in output is likely to occur only when anticipated prices are markedly below normal.

Questions

1. Contrast agriculture and industry in America, with particular emphasis on (a) how they have changed in the last half-century; (b) their present relative status.

2. Compare modern industry and agriculture as to:
    (a) Size of unit.
    (b) Control of output.
    (c) Mode of production.
    (d) Risks.
    (e) Financing.
    (f) Training required.

3. What do you understand by the word "farm"?

4. To what extent is modern farming self-sufficient?

5. "The average farmer supplies from his farm (a) 75 per cent of human labor, (b) 90 per cent of the horse power, (c) 85 per cent of the feed, (d) 50 per cent of the family food, fuel, and shelter, of all that are consumed on the farm." Wherein is this true and where untrue?

6. Compare farm managers with factory managers as to (a) employer, (b) nature of connection with the enterprise, (c) method of compensation.

7. What factors tend to keep agricultural production in small independent units?

8. Why is it difficult for farmers to standardize their products?

References

App, Frank, and Waller, Allen G., *Farm Economics and Distribution.* Philadelphia: Lippincott, 1938, Chapter I.

Carver, T. N., *Principles of Rural Economics.* Boston: Ginn, 1911, Chapter II.

Holmes, C. L., *Economics of Farm Organization and Management.* Boston: Heath, 1928, Chapter I.

King, Willford I., *Income of the United States.* New York: National Bureau of Economic Research, 1922, Part II.

Nourse, Edwin G., *American Agriculture and the European Market.* New York: McGraw-Hill, 1924, Chapter I.

Seligman, Edwin R. A., *Economics of Farm Relief.* New York: Columbia University Press, 1928, Chapter I.

——————, *Farm Credit Administration.* New York: American Institute of Banking, 1934, Chapter I.

U. S. Department of Agriculture, *Department Bulletin 1269,* "Relationship of Land Tenure to Plantation Organization," by C. O. Brannen, 1924.

U. S. Department of Agriculture, *Farmers' Bulletin 635,* "What the Farm Contributes Directly to the Farmers' Living," by W. C. Funk, 1914.

U. S. Department of Agriculture, *Farmers' Bulletin 410,* "Value to Farm Families of Food, Fuel, and Use of House," by W. C. Funk, 1916.

U. S. Department of Agriculture, *Department Bulletin 1338,* "The Family Living from the Farm," by H. W. Hawthorne, 1925.

U. S. Department of Agriculture, *Department Bulletin 1466,* "The Farmer's Standard of Living," by E. L. Kirkpatrick, 1926.

U. S. Department of Agriculture, *Department Bulletin 1348,* "An Appraisal of Farm Power on Farms in the United States," by C. D. Kinsman, 1925.

Warren, G. F., *Farm Management.* New York: Macmillan, 1916, Chapter I.

CHAPTER II

The Nature of Farm Management

THE subject of farm organization and management is usually treated under the more general term "farm management." This terminology has the advantage of brevity and the sanction of long usage. It should be pointed out, however, that the term is somewhat misleading, as it focuses attention on management to the possible neglect of organization. It is important to recognize the distinction between these two functions of the farm operator. Organization refers specifically to the function of creating the general scheme or plan of production, whereas management refers to the function of putting the scheme into operation and of making those adjustments in the business which are necessary in order to obtain the maximum economic returns from the farm business as a whole. In this text, when the term farm management is used, it refers to both organization and management of the farm, unless otherwise stated.

1. Various Concepts of Farm Management

Farm management has been defined as an art, a science, and a business. Gray says that the *art* of managing a farm successfully as measured by the test of profitableness is called *farm management.*[1] Taylor states that farm management is literally the art of managing a farm.[2] Boss defines farm management as the art of applying business and the scientific principles to the organization and operation of a farm.[3] Warren defines farm management as the science of organization and management of the farm enterprises for the purpose of securing the greatest continuous profit.[4] Moorhouse is of the opinion that farm management is the study which deals with the business phase of farming.[5] Holmes defines it as [a study] of the principles underlying the farmer functioning as a business proprietor.[6] And according to Spillman, farm management treats of the business of farming from the standpoint of relative desirability of farming and other lines of business, the selection of the farm, the organization and equipment of the farm, and the farm operator.[7]

---

[1] Gray, *Introduction to Agricultural Economics,* p. 3.

[2] Taylor, Tolley, and Tapp, "Practical Farm Economics," U.S.D.A., *Miscellaneous Circular 32,* p. iv.

These varied definitions may be confusing and can be harmonized only when the point of view in each case is clearly stated. Farm management may be properly considered as an art, a science, or a business. A science is usually defined as a body of truths systematized and arranged in such a way as to show the operations of general laws or principles. Such a body of knowledge is obtained through systematic study and research. To the extent that we are concerned with methods of collecting and analyzing data for the purpose of evolving general principles or laws peculiar to the economics of production, the subject of farm management may be considered as a science. When approached from this standpoint, it involves a treatment greatly different from that when approached from the standpoint of an art on the one hand or a business on the other. To treat the subject as a science would involve more particularly a statement of research objectives, the development of method of collecting and analyzing the data obtained, and the deduction or formulation of general laws or principles peculiar to this subject. Whether or not farm management can be accurately called a distinctive science is a question which we are not called upon in this connection to answer. It may be said in passing that research and experimentation in this field have brought together a considerable body of knowledge from which have been deducted certain laws and principles that are useful in the operation of a farm and also in the determining of public policies. In the main, however, the principles are not peculiar to farm management but rather are part of the general science of economics.

---

[3] Boss, *Farm Management,* p. 17.

[4] Warren, *Farm Management,* p. v.

[5] Moorhouse, *The Management of the Farm,* p. vii.

[6] Holmes, *Economics of Farm Organization and Management,* p. 27.

[7] Spillman, "What Is Farm Management?" p. 7. U. S. Department of Agriculture, *Bulletin 259.*

It is possible also and highly desirable to study farming from the standpoint of an art. The word *art* connotes skill or dexterity not only in the physical but also in the mental sense. The study of farming from this point of view would mean a careful examination of the thought processes and dexterity used by farmers in doing their many farm tasks and chores. It would not be a study of the quality and quantity of various factors used in production and the effect of these on production, costs, and returns. It would be rather a study of the theory and practice of the skills used in performing farm tasks. It is common knowledge that some farmers are able to do a given task more quickly, with greater ease, and in a better way than other farmers. We say that these farmers are skillful or artistic, since their movements appear almost effortless. Can these peculiar skills be studied and the results put into such form as will be useful to less skillful farmers or to young men and boys just starting farming? There is no question but that one engaging in such a study would encounter many difficulties. Investigations in scientific management would indicate, nevertheless, that such a study is not impossible and would yield fruitful results. However, the study of farm management as an art would require an approach somewhat different from that required by the study of the sciences of production on the one hand or of a business on the other.

A business is usually thought of as an enterprise organized and operated primarily for profit. Farming, according to this definition, would come within the category of a business. In the conduct of a farm enterprise, the farmer is an entrepreneur, and as such he should apply business principles to the organization and management of the farm if he expects to utilize his resources to the best advantage. It is from the point of view of a business that we shall treat the subject, and not from the standpoint of a science or of an art, except perhaps incidentally. That is, we are concerned chiefly with the problem of planning and scheming to the end that the farmer will be able to use his labor and capital to get the maximum net returns. It should be pointed out, however, that farming differs from the ordinary type of business. It has certain features that are not found in the ordinary commercial or industrial enterprise. The farmer is not a typical business executive. These differences, considered in detail in Chapter I, are important and should be kept in mind in planning the organization and management of the farm.

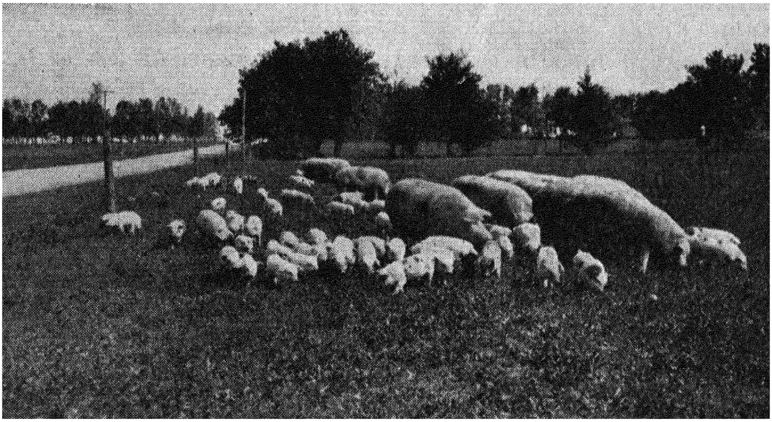
2. Farm Management and the Technical Sciences

Some writers have attempted to elucidate their concept of farm management by comparing it with the technical agricultural subjects. Professor Boss, for example, differentiates between agronomy and farm management as follows: "How shall I grow corn is clearly an agronomy question. How shall I select and grow cattle is just as clearly a question in animal husbandry. But the questions, Shall I grow corn, some other crop, or cattle or hogs, are farm management questions." [3]

This method of distinguishing between farm management and technical sciences is not, perhaps, incorrect, although it is rather simple. The actual growing of a crop or a class of livestock may not be purely technical. If the major objective is one of measuring the effects of the input on the physical output, the problem may be properly viewed as one of agronomy or animal husbandry or any other of the so-called technical sciences. For example, in the production of a given crop, as more fertilizer is used, other factors being held constant, the output will normally increase. In the feeding of livestock, if the amount of feed is increased, normally the weight of the animals or the flow of milk will be increased. This is purely a technical problem.[9] But from the standpoint of the farmer, the relationship between the input and the output is more than a technical problem; it is also an economic problem. The farmer's interest lies in adjusting the inputs (that is, in obtaining the combination of the various inputs) so as to get the maximum net returns, not necessarily from any one specific crop or livestock product but from the farm as a whole. In short, the task of the farmer from the standpoint of a business proprietor is to know the effect on the physical output of adding more or less of one factor, and

---

[3] See Boss, *op. cit.*, p. 20.



Courtesy of South Dakota Agr. Exp. Sta.

Fig. 5. Production is not solely a problem of physical output, but it is also one of using the factors of production to obtain the maximum net returns.

---

[9] Probably it is from this point of view that Professor Boss approaches the problem, but his position is by no means clear.

in being able to decide which of a number of combinations of input factors is or will be most profitable. *The real distinction, therefore, between the technical sciences and farm management is that the former deal primarily with the relationship between physical inputs and physical outputs; the latter, primarily with the problem of getting the most profitable combination of the various factors used in production.*

If there is any confusion as to this distinction, it may be clarified by a few illustrations.[10] Experiments with fertilizer usually show the effect of the additional fertilizer on output or yield. Increasing the amount of fertilizer on a given crop on a given type of soil increases the total production. This may be designated as an agronomy problem. The function of the farmer as a business proprietor is to decide at what point in the application of fertilizer it will best pay him to stop. Will he add x quantity of fertilizer, or $2x$, or $3x$? Again, it is the task of the technologist to experiment with the effect on output of the number of cultivations, the effect on output of the depth of plowing, and the effect on output of the number of sprayings. But it is the problem of the farmer as a businessman to decide whether or not to plow deep or shallow, to cultivate one or more times, to plant more or less seed, to use more or less feed. True, the farmer may add to his total output by increasing the number of cultivations, by adding more fertilizer, or by plowing deeper; he may increase his milk production by feeding more heavily; or he may increase the weight of steers by the same process. However, the farmer is faced constantly with the problem: Will it pay better to do any of these things, and, if so, to what extent? The question is economic in character and lies within the province of the farm economist, whereas the physical relation between input and output is essentially within the province of the agricultural technician.

---

[10] See also Chapter XII.

3. Farm Management and the Social Sciences

To describe more accurately the nature of farm management, some writers have compared it with the social sciences, more especially with general economics and agricultural economics. Some authorities have been inclined to give farm management a distinct or separate classification from either general economics or agricultural economics. The classification of farm management as a distinct subject is based on the theory that farm management deals primarily with private economy, whereas other branches of agricultural economics are concerned chiefly with collective or public economy. Other writers object to this theory. They define agricultural economics as a science in which the principles and methods of general economics are applied to the special conditions of agriculture as an industry. In short, agricultural economics is an applied science, just as railroad economics or money and banking are applied sciences. And as the economic problems in agriculture are diverse, it follows that there are many more or less distinct branches of agricultural economics, such as agricultural credit, agricultural taxation, farm labor, land utilization, agricultural prices, farm organization and management, and the like.

The disciples of the second school do not deny that farm management is a study in private economy, but they claim it is not confined solely to private economy. They hold that certain phases of farm management are affected by public interest, and they point out that in many cases the farmers' actions are limited by public authorities. For example, in the production of milk for urban consumption, certain rules and regulations are prescribed for the production of milk in order to assure a sanitary product. Similarly, the farmers producing certified seed for general distribution are normally compelled to comply with certain regulations laid down by the state. Regulations or legislation regarding taxation, tariffs, prices, and credit affect the way in which the farm will be organized and operated. On the other hand, it is pointed out that such subjects as farm credit, farm taxation, and agricultural tariffs, while primarily of public concern, have their individual aspects. The individual farmer has his own credit problems, his own tax problems, and his own tenure problems. It is impossible, so it is said, to make the distinction between agricultural economics and farm management on the basis of collective and individual economies. Therefore, farm management must be classified as a division or a segment of agricultural economics.

4. Definition of Farm Management

Distinctions of this kind are interesting and helpful, although they do not supply a precise explanation of the nature of farm management. A better approach to this subject may be made by asking this question: What are the functions of the farmer? That is, what does he do? What rôle does he play? It is evident to everyone who is familiar with farming that the farmer performs more than one function. Warren recognizes this multifunctional nature of the farmer when he says: "The farmer is a combination of businessman, mechanic, naturalist, and laborer."[11] Gray recognizes this fact also when he enumerates the many qualifications the farmer must have.[12] A simple enumeration of the various rôles of the farmer does not explain farm management. It is true, perhaps, that the farmer, in order to be successful, should have an expert knowledge of technical agricultural sciences and a flair for the natural sciences; he should be an expert mechanic and a capable and industrious laborer. But a study of these functions does not properly belong in the field of farm management. If it did, then it would be necessary to write an encyclopedia on farming. There is, however, one function of the farmer that does relate directly to farm management, and that is the function of entrepreneurship. As a business entrepreneur the farmer acts as an organizer and operator of land, labor, and capital. His success as a business proprietor will depend directly on his ability to organize and manage these factors of production. *Farm management, then, may be defined as a study of the ways and means of organizing land, labor, and capital, and the application of technical knowledge and skill in order that the farm may be made to yield the maximum net returns.* In a study of this character every factor is given consideration, whether agronomic, social, or economic. Information of all kinds is so much grist in the mill, and each kind is given attention to the extent that it may be useful in organizing and managing the farm to the end that all of the factors of production will be utilized to the best advantage; that is, made to yield the maximum net returns for the farm as a whole.

---

[11] Warren, *op. cit.*, p. 1.

[12] Gray, *op. cit.*, pp. 29–30.

Questions

1. Why has farm management been classed as (a) an art, (b) a science, (c) a business? Which do you prefer? Why?
2. Describe the relationship between farm management and the technical sciences of agronomy, animal husbandry, and so forth.
3. Define farm management.

References

Boss, Andrew, *Farm Management.* New York: Lyons and Carnahan, 1914, Chapter II.

Gray, L. C., *Introduction to Agricultural Economics.* New York: Macmillan, 1924, Chapter I.

Holmes, L. C., *Economics of Farm Organization and Management.* New York: Heath, 1928, Chapter I.

Moorhouse, L. A., *The Management of the Farm.* New York: D. Appleton-Century Co., 1925.

U. S. Department of Agriculture, Bureau of Plant Industry, *Bulletin 259*, "What Is Farm Management?" by W. J. Spillman.

U. S. Department of Agriculture, *Misc. Circular 32*, "Practical Farm Economics," by H. R. Tolley, H. C. Taylor, J. W. Tapp.

Warren, G. F., *Farm Management.* New York: Macmillan, 1916.

CHAPTER III

The Development of Farm Management

FARM MANAGEMENT as a study of the causes of success or failure of the farm enterprise began, no doubt, as soon as farming passed out of the purely self-sufficient stage. There is some historical evidence that farm management as such was given attention at an early date, for we find in the writings of the Chinese, Egyptians, Greeks, Romans, and other ancient peoples many statements relating to the operation and organization of the farm. Scientific work in this field was necessarily delayed, however, until the fundamental sciences, more especially economics, statistics, and accounting, were developed. To trace the history of farm management throughout the ages, and especially during the nineteenth century, would be a fascinating task, but this cannot be undertaken here. Such a story belongs more properly to the history of agriculture. The purpose of this chapter is to trace briefly the development of farm management in the United States and in foreign countries from the beginning of the present century.

1. The Development in the United States

Beginnings in farm management. There was little work of a scientific character done in farm management in the United States prior to 1900;[1] however, some consideration must be given to certain cost studies that were conducted as early as 1845 by the Agricultural Section of the Patent

---

[1] Warren, "The Development of Farm Economics"; also Sigmund von Frauendorfer, "Development Methods and Results of Agricultural Economic Research in the United States."

Office. That these studies partook of the nature of farm management is indicated by the objective stated by the Commissioner of Patent, under whose direction they were made. He says: [2] "Let our motto be the greatest amount of produce at the least expense. Profit is our object, and how shall we secure it except by cheapening the cost of production?"

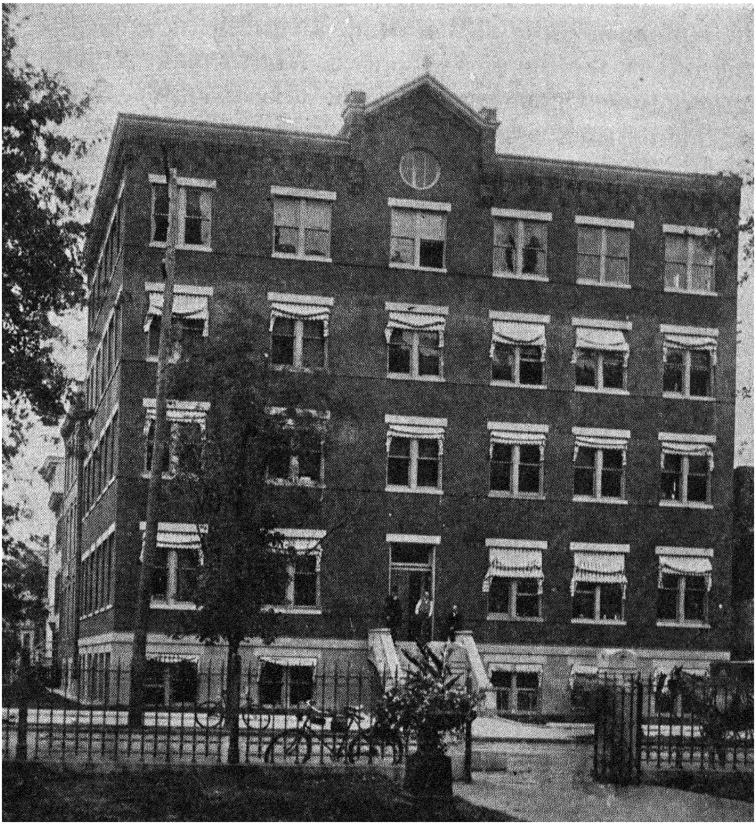


Illustration from Bu. of Agr. Econ.

Fig. 6. The Building that Housed the Office of Farm Management and Farm Economics, Corner B and 14th Streets, N. W., Washington, D. C.

There were, in addition to the studies made by the Patent Office, a number of other cost studies. According to Bennett, there were no less than a dozen such investigations made prior to 1902.[3] Horner in his studies of governmental activities found few references to farm management in the early government reports. In 1867 there was a report by a special committee on farm management given in the annual meeting of the Maine Board of Agriculture. In this report the distinction between farm management and agronomy was not clearly drawn. For example, the report considered such subjects as "the size of farm, the exhausting quality of oat crop, effective measures to increase hay crop, should more beans and peas be grown, the efficiency of ox yoke, shall farm fruits and vegetables be cultivated more extensively, and the use of improved implements." [4]

---

[2] Cited by Horner, "Governmental Activities Prior to 1913."

Although the attention given to farm management prior to 1900 was chiefly superficial, the interest in the subject grew as the farm problem became more and more acute. It was inevitable that agricultural leaders and students of farming would attempt to find causes and remedies for the conditions which existed.[5] Excessive costs and economical production were advanced as the chief cause and remedy respectively for the farmers' ills. But the first scientific study of costs was not begun until in 1902. Willett M. Hays of the Minnesota Experiment Station was responsible for this initial study. He introduced a new method. The cost data were obtained not by questionnaires, as formerly, but by visiting at frequent intervals a limited number of farmers in a homogeneous agricultural area and obtaining all the information necessary to the compiling of production costs. The method became known as the "Route Method" of studying farm management problems.

The route method, as developed by Hays in Minnesota, did not at first attract much attention, but later the idea spread to other states. By 1920, according to Bennett, six state agricultural experiment stations were conducting investigations by this method; in 1926–27 twenty-three state experiment stations were operating thirty-five routes.

---

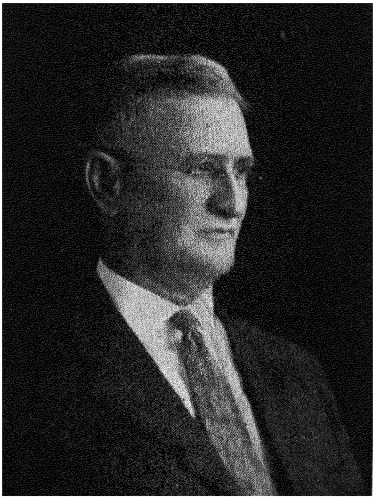
[3] Bennett, *Farm Cost Studies in the United States,* pp. 14–17.

[4] Horner, *op. cit.*

[5] Bennett, *op. cit.*, p. 17.

About this time (between 1902 and 1907), Professor T. F. Hunt, an agronomist, was giving much of his time and thought to the field of farm management. He began his work at the University of Ohio, where his lectures included material on the history of agriculture, public policy, and farm management. Hunt left Ohio and went to Cornell in 1903, and at the latter institution his courses, although covering a variety of subjects, dealt mostly with farm management and included a farm management problem. This problem was designed for the study of the farm in a detailed fashion. For example, a map was made of a specific farm, and all available data were collected regarding the farm operations. Finally, a detailed plan for its operation was projected for a five-year period.[6]

The work of Spillman, Warren, and Taylor. The work of Hays and his assistants together with the stimulating teaching of Hunt at Cornell led to the establishment of research work in farm management in the Department of Agriculture. The leading spirit was W. J. Spillman, who was originally a student of technical agriculture but who had diversified interests, having studied and written extensively in the fields of physics and genetics, as well as on agronomic subjects.



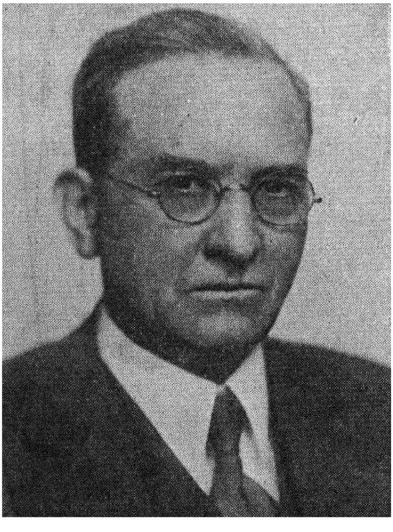
W. J. Spillman

Through Spillman's efforts, James Wilson, then Secretary of Agriculture, recognized farm management as a separate and distinct field of research. At the outset, the work was located in the Bureau of Plant Industry, without a separate appropriation. It was not until June 30, 1907, that a definite appropriation was made by Congress for research in farm management. The appropriation bill of that year has the following phraseology: "To investigate and encourage the adoption of appropriate methods in farm management and practice." [7]

---

[6] Warren, *op. cit.*

As a result of this appropriation the Office of Farm Management was set up, under the direction of Spillman, as a part of the Bureau of Plant Industry. Here it remained until 1915, when it was transferred to the office of the Secretary and was called the Office of Farm Management and Farm Economics.[8]



G. F. Warren

Spillman's work was confined, in the early stages at least, to a series of studies relating to the organization and management of farms which had been, according to Spillman,[9] successful. Of these early studies, *A Model Farm* (Yearbook Separate 323) is typical. This publication is a brief but interesting description of a farm located in Southern Pennsylvania.

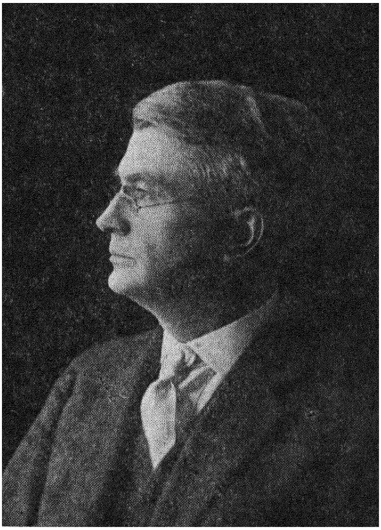
Spillman's thinking and methods of study were greatly modified by the work that G. F. Warren, in the meantime, had started at Cornell. Warren's fundamental idea was that the factors affecting success or failure of the farm could be discovered only by a study of a large number of farms in a homogeneous farming area. For this purpose he developed what was designated as the "Survey Method." After some experimentation with this method, he published the results of a survey in 1911.[10] This bulletin, with its somewhat dogmatic conclusions, made a deep and lasting impression on the students and investigators who were working under Spillman, as well as on those in the state experiment stations. The use of the survey method spread rapidly, and a large number of farm management bulletins appeared between 1909 and 1918.

---

[7] U. S. Department of Agriculture, *Annual Report of the Office of Farm Management,* Fiscal Year Ending June 30, 1922.

[8] U. S. Department of Agriculture, *Annual Report of the Office of Farm Management,* Year Ending June 30, 1922, List of Bulletins.

[9] U. S. Department of Agriculture. *Yearbook,* 1903, p. 369.



H. C. Taylor

Commencing in 1901, another investigator who was to leave his imprint upon research in the field of farm management had begun work in Wisconsin. This investigator was Henry C. Taylor, who, encouraged by Professor R. T. Ely, turned his attention to the economic problems of the farm. He was especially interested in the subject of land tenure and farm prices. His first notable publication is entitled *Agricultural Economics*. This book, consisting of thirteen chapters, deals largely with the problem of organizing and managing individual farms.

Taylor, whose work had become nationally known by 1915, was destined to supersede Spillman in the Office of

---

[10] Warren, G. F., and Livermore, K. C., "An Agricultural Survey," *Cornell Bulletin No. 295*.

Farm Management. The change in leadership came about in this fashion. During World War I there was a demand by agricultural leaders for cost data relative to producing farm commodities. The data were to be used to set the price of farm products by government fiat. The lay theory was that prices must equal the cost of production. With this idea David Houston, then Secretary of Agriculture, had little or no sympathy. In fact, he opposed the gathering of cost data for such a purpose, especially by the method used by Spillman. Friction developed between the two, and Spillman was forced to resign. There then followed an investigation, at the suggestion of the Secretary, of the work of the Office of Farm Management by a committee composed of *prominent men in the field of farm management research.*[11] The report of this committee was favorably received by Secretary Houston; and Taylor, who was a member of the committee, was asked to assume the responsibility of directing the work of the Office of Farm Management. He took office in 1918. In 1919 the name of the office was changed to the Office of Farm Management and Farm Economics and this was made an independent office distinct from the Office of the Secretary, although not given the standing of an independent bureau.

Taylor, while Chief of the Office of Farm Management and Farm Economics, and later as Chief of the Bureau of Agricultural Economics, very definitely influenced the research work in the field of farm management. He broadened its base by introducing new studies, gave it more definiteness by stating clearly the objective, and made the information more accurate by introducing approved statistical procedure in the analysis and collection of the data. Although Taylor did not write a great deal, his ability to direct research work became evident through the brilliant work of such men as L. C. Gray, O. C. Stine, O. E. Baker,

---

[11] U. S. Department of Agriculture *Circulars 132, 135, 138, 139.*

H. R. Tolley, J. W. Tapp, J. D. Black, Mordecai Ezekiel, F. F. Elliott, and others who worked under him.

In 1922 the Office of Farm Management and Farm Economics was combined with the Bureau of Markets and the Bureau of Crop Estimates to form the Bureau of Agricultural Economics, which came into existence on July 1, 1922, and the old Office of Farm Management and Farm Economics, with its long and notable history, came to an end.

Recent developments. Since the formation of the Bureau of Agricultural Economics, the work of farm management has been modified, not so much in objective as in methods of research. The changes which have taken place are stated by Mr. Tolley as follows:[12]

> Let me mention first recent developments in farm organization and farm management research, and begin with type-of-farming studies. Dr. Spillman[13] did much pioneer work on these studies using the results of the 1920 census of agriculture. Recent developments include a procedure for determining and portraying type-of-farming areas, the typical farming system or systems in each area, and the historical changes which have occurred. The procedure is based largely on the use of census data, and, if we can be content with a quinquennial portrayal of changes, it gives practically as complete and satisfactory results as could be obtained from data collected specifically for these studies. A considerable number of states, in which soil and climatic conditions are fairly homogeneous, have brought to a successful conclusion projects of this type. A procedure suitable for states or areas where there are wide variations in soil and climatic conditions is yet to be developed.
>
> Another phase of type-of-farming studies attempts to determine the comparative advantage of the existing types over other types that might have developed in an area. This phase of a type-of-farming study would, no doubt, often result in the conclusion that some type or types, other than those actually found in an area, would be more profitable and of higher comparative advantage. The best study along this line that has been published to date is reported in Iowa Bulletin 259.
>
> Another phase of type-of-farming studies involves determining *why* type-of-farming areas shift and *why* the systems of farming within an area change. Procedure for this phase is still in the developmental stage.

---

[12] Tolley, "Recent Developments in Research Method and Procedure in Agricultural Economics," pp. 217–19.

[13] Dr. Spillman had joined the staff of the Bureau of Agricultural Economics after a brief experience in agricultural journalism.

Closely related to this phase of type-of-farming studies are the so-called elasticity of supply studies that have as their object measuring the group-response of farmers in their production and marketing programs to changes in prices and other factors. It has long been recognized that there is a fairly close relationship between changes in price and subsequent changes in supply of agricultural productions coming from a particular area or region or country, but attempts to obtain quantitative measures of this relationship are a recent development in agricultural economics. Already a number of worth-while studies have been made, some designed to show the relationship between the price and the supply of a product for the country as a whole, others dealing with a single area or region. In all of these studies the statistical method—principally multiple curvilinear correlation—has been used. That is, an accepted method has been applied in a newly developed line of research. The most serious handicap in these studies is the lack of adequate data. Available data on acreages of crops and numbers of livestock by small geographical units are scanty and often unreliable. Studies to date have dealt almost entirely with acreages and numbers of livestock. A procedure for measuring the relationship between changes in prices and changes in intensity of cultivation and feeding has not yet been worked out.

Turning to the studies designed to show most profitable systems of farming and methods of production we find a noteworthy recent development—in this country at least—in the rather general adoption of the budgeting method of approach to the problem.[14] Dr. Holmes has called this the Method of Estimation; Dr. Black has called it the Method of Substitution. While this is a recent development in the United States the budgeting or "advance-estimate" method of approach has been used for a century or more in Germany. Dr. Walter J. Roth, who spent last year in Europe studying methods of procedure in farm management research there, says there is practically a unanimity of feeling on the part of German farm-management workers as to the importance of the advance budgeting of probable earnings.

In the budget approach it is necessary to study the results to be expected from the numerous possible combinations of enterprises and resources of a farm in the light of changing price relationships and in the light of the physical conditions under which production takes place as well as in the light of the managerial capacity of the operator and the practices he uses.

In some research studies made to date too little attention has been given to the question of which of the many factors of production is most limited and around which the organization might most profitably be built. Most of the budgeting studies have been made on the basis of an "average" curve of output per unit of input (the so-called average unit requirements). Obviously, refined results cannot be obtained with such data. As input-output data become more complete and show more definitely what particular outputs follow from given sets of input factors, farm budgeting results will improve. There have been some significant recent developments in the procedure of determining input-output relationships and it is to be hoped that developments will continue until generally applicable results are available.

---

[14] The method of budgeting as developed in this country was first presented by the author about 1922 in an address delivered at Asheville, North Carolina. Later it was presented in *Research Bulletin No. 1,* Bureau of Economic Research, N. C. State College, Raleigh, N. C.

Procedure for measuring the managerial capacity of the farm operator, and for determining the relation between his ability to cope with the problems of proprietorship and the most profitable system of farming for him, has not yet begun to take form.

2. The Development in European Countries

Germany. Farm management, as a distinct study, is somewhat older in Europe than in the United States. The first indications of any realization of the function of farm management are found in the writings of European agriculturists in the early part of the nineteenth century. At the outset, development was slow and hesitant, but important advancements were made during the last decades of the century. This was particularly true in Germany, where the study of farm management has reached its fullest development among the European countries. It is to be noted, too, that, in Germany, the study is over a century old, dating back to the writing and works of Albrecht D. Thaer in the early part of the nineteenth century.

Albrecht D. Thaer

Another early German writer was Heinrich von Thuenen, whose contributions were also in the form of new methods and subjects rather than of any direct work. But during the latter part of the nineteenth century, the work begun by Thaer and Von Thuenen was revived and carried forward by other students, chiefly Von der Goltz, Kraemer and Pohl. In the meantime, individual phases of the problem, especially systems of accounting and principles of proprietorship on large estates, had received special attention and had been developed extensively.

In the last part of the nineteenth century Von der Goltz developed a new line of approach, considerably broader than that suggested by Thaer or Von Thuenen. Nevertheless it failed to develop fully the ideas later embodied in the writing of Friedrich Aereboe. Friedrich Aereboe, a student of Von der Goltz, formulated a new approach to farm management. Aereboe's experiences with the Division of Accounting of the Agricultural Society (Berlin) and as manager of various large estates were instrumental in forming his ideas and methods of approach. According to one of his principles he considers the farm as requiring a biological study. He stresses the mutual relationship between the individual farm enterprises, and discounts cost accounting as a method of approach to the problem of organization. Cost accounting, according to Aereboe, is an unsatisfactory and an insufficient method, because "it dissects the body of the farm in an anatomical manner, and in so doing kills it for the purpose of real study of economic efficiency." [15] He does not deny the value of cost accounting entirely but suggests the use of it for control of farm business and not for the final measure of economic efficiency. Aereboe's concept of the field as a whole is that "Farm Economics has to do with the farm as an organic entity in which the individual element has to coördinate with the whole, regardless of how the individual enterprise comes out, considering only the service to the whole. . . . High physical production from plants or animals never is an end in itself, but merely a means to an end. It must assign a disadvantageous place to one crop in order to give another one a better plan and thereby enhance the income from the farm."

---

[15] Stippler, "Philosophy of Aereboe as Related to Scope and Method of Research in Farm Management."

In the individual phases of the study of farm organization Aereboe outlines some general principles:

> As a starting point for his investigations of farm organization, Aereboe takes first the existing accommodations (resources of the farm) and the available labor. All the existing accommodations must be brought into full utilization and in such manner as to make continued use of the available labor. After that he explains the combinations and correlations of the different methods of cultivation, the individual crops, and the means of utilization of all products in the division of labor and land. The next step is the explanation of the most suitable forms of organization for the best use of the factors of production, including the land itself. He investigates the different forms of organization from different angles and under varying conditions. Much space is devoted by Aereboe to the influence of price upon the forms of organization and land utilization. In his discussions he consciously places the influence of the economic situation, especially the influence of sale prices and production costs upon the form of agriculture, ahead of the influence of natural conditions. On an extensive area and over a period of time the influence of the farmer is of greater importance than the latter. The discussion of the influence of the natural conditions upon farm organization includes the influence of heat, precipitation, soil, etc. This discussion is followed by explanations of the influence of the status of technique, of the legal conditions attending property rights, and of the distribution and location of the fields.[16]

Before World War II Germany had a fairly well rounded farm management research and a broad system of instruction in the universities. Problems relating to other branches of agricultural economics, including marketing and land tenure, had been more pressing in their demands on the research worker, but the study of management as an economic approach had made rapid strides. German economists who were also familiar with American methods of approach consider the German approach as deductive and the American as inductive. Thus, Sigmund von Frauendorfer states: "On the German side, there is an 'intuitive' grasp of truth and a never-failing sense for systematic arrangement." In Germany there was, however, more tension between the farmer and the scientist than in America, a tension caused largely by intellectual pride, which often makes collaboration between the two a peculiar problem.

---

[16] *Ibid.*, pages 601–602.

Switzerland. Ernst Laur, the principal farm economist in Switzerland, is an exponent of cost accounting as an approach to the farm management problem. In Switzerland, systems of accounting were in use during the nineteenth century, and were supervised by the Government or carried on by large estate owners. Laur, who has been in charge of these accounts in recent years, developed his theories at the same time as Aereboe developed his in Germany. But, unlike Aereboe, Laur took the problems of the small farmer as his basis for analysis of farm management problems and advocated independent cost accounting analysis[17] of individual enterprises as the foundation for business analysis and production guidance of the farm. His approach is of special significance because it is distinctly different from that advanced by Aereboe and also because it has been followed by many of the smaller countries in Europe, notably Denmark, Sweden, and Norway.

The distinction between Aereboe's and Laur's ideas is well stated by Holmes:[18]

> These two [Aereboe and Laur] are at considerable variance in their conception of the farm management problem, particularly the theory and practice of farm business analysis. Aereboe, who has held teaching and research positions in various German universities and has had successful experience in practical estate management, has for many years conducted a farm accounting service for the proprietors of German estates. His point of view in farm management is that of the large scale operator. On the other hand, Laur, for many years professor of rural economics at the Zurich Polytechnic, who as secretary of the Union Suisso des Paysans has supervised an account keeping service for Swiss peasant farmers and conducted researches in farm accounting and farm management, takes the problems of the small farmer as his basis for analysis of farm management problems. On the technical side Laur is

---

[17] It should be noted that Laur's theories are not unlike the early American works, especially those of Spillman, Warren, and their disciples.

[18] Holmes, "Farm Management," pages 112–113.

an ardent supporter of detailed and independent cost accounting analysis of the various separate enterprises making up the farm business as the foundation for business analysis and production guidance; whereas Aereboe conceives of the farm as a closely knit organism and regards the effort at financial analysis of the production of an individual crop or class of livestock as artificial and misleading.

England. Interest in farm management in England may be traced to Arthur Young. Young, a contemporary of Thaer, traveled widely and wrote much on farming. His published treatises based largely on observations made while traveling in England and on the Continent are concerned largely with farm proprietorship. In this there is a similarity to the case method of research today, but, of course, it is a much more shallow treatment. In England, as in many other countries, more urgent interest in other problems has taken the time of scientists who might have developed farm management. After the Napoleonic Wars, English agriculturists were deeply concerned over the tariff; and, after that was settled, they were concerned with the problem of land tenure. Progress in farm management investigations has been relatively rapid, however, during the last few years. A number of research institutions which have considered farm management as a major problem have been set up. The Agriculture Economic Research Institute, organized in 1931 at Oxford University, is, perhaps, the most notable of these.

Cost of production studies constitute the most prevalent type of research in English farm management. The problems of broader scope have received minor emphasis in comparison to "costing," as the cost work is called in England. It is not to be understood that the economists engaged in research do not use other approaches. C. S. Orwin, one of the most prominent writers on agricultural economics in England today, in a discussion of the three methods of approach—costing, the survey method, and financial accounts—brings out the fact that all three aim at the same object and at the same principles of analysis. There appears to be a growing interest in the statistical analyses and a demand that they be published in conjunction with the publication of recommendations from economists based on interpretation of statistical data. The "case" method has also been used and is considered of significance in some instances. Cost of production studies, however, retain their place of importance. Witness, for example, the concluding statement of Mr. Orwin in a recent article: "Clearly, for a great number of farmers, things cannot go on as they are much longer. I urge them to consider, each one for himself, in the light of his own circumstances, the possibility of the reduction of costs by concentration on the production of each commodity in the cheapest possible way, considered entirely by itself. In so doing, I assure them that I am not expressing an armchair opinion. I am drawing solely on the experience of men who are farming successfully in the English countryside today."[19] One sees in this brief statement the stress put on cost of production, the anatomical manner in which the farm business is analyzed, and, at the same time, an illustrative use of the case method instead of the statistical analysis approach.

Russia.[20] The situation in Russia has been, since the Revolution, a highly dynamic one. Unfortunately, there is no book or article available on the specific subject of farm management, but sufficient material is available to develop a fairly satisfactory account of farm organization and management in the U. S. S. R.

To understand the situation in Russia, it is necessary to appreciate the attitude and point of view of the Russian leaders. Although the leading members of the Russian Communist Party are inveterate theorists, they are at the same time intensely practical. The chief aim of the Russian Communist Party is an increase in productive efficiency and the creation of environment suitable for the development and advancement of communism. Obviously, these objectives are not always in harmony, and the Communist leaders do not hesitate to sacrifice one temporarily to hasten the attainment of the other. This explains why their plans and counterplans go forward with such lightning-like changes.

---

[19] Orwin, "Cutting the Farmer's Costs."

[20] Material on Russian farm management is widely scattered. See "Economic Life of Soviet Russia" by Calvin Hoover; *New Russia's Primer* by M. Ilin; "Applied Marxism in Soviet Russia" by G. Tuckerman.

In the United States and other capitalistic nations the main objective of farming is to obtain the maximum net economic returns. If, for example, the medium-sized farms are more productive than large ones, there is no hesitancy on our part to advocate medium-sized farms. If agricultural coöperatives are able to operate more efficiently than private businesses, they should immediately be developed. If they fail to accomplish their objective, they are abandoned. If mechanization of agriculture contributes to greater production and profit, it is employed; if not, it, too, is abandoned. However, in Russia, large farms, collective agriculture, and mechanization are not merely means by which productivity may be increased; they are objectives in themselves of equal if not greater importance than the increase in productivity.

These objectives together with the extirpation of private property were, according to the Russian leaders, necessary to the creation of a communistic state. The acquisition of private property by the Soviet was by no means complete at the close of the Revolution. It is true that a degree was promulgated to the effect, but the peasants *(muzhik)* were permitted to retain their land and control their production. Likewise, the class of comparatively rich peasants *(kulaki)*, more diligent and intelligent than the rest, remained, rented land, and employed labor. In 1930, however, Stalin thought that the time had come to eliminate capitalistic elements from farming. In the place of the individual agriculture the government demanded the setting up of collective farms *(kolkhozi)* of the artel type. This procedure was to get rid of capitalistic farming. A secondary objective was an increase in economic productivity. If economic productivity had been the major objective, then the *kulaki,* rather than the poor and inefficient peasant *(bedniaki),* would have been the nucleus about which the new system would have been developed.

According to the communistic doctrine, the environment most suitable to the flourishing of communism is a mechanistic one. The proletarian who is divorced from ownership must form, according to communistic beliefs, the basis for communism; and all peasants must be brought within this class. Consequently, state farms *(sovhozi)* were organized on a mechanized basis to serve as models for the *kolkhozi.* Tractor stations were set up to serve the surrounding *kolkhozi,* and it was hoped that this would increase productivity; but again this was not the major objective of the change. The chief end in view was the creation of a mechanized rural environment and a development of the *kolkhozi* agricultural class. It is evident, therefore, that farm management in Russia is on a much different basis from that in capitalistic countries. Instead of one objective, the obtaining of maximum economic returns, there are in Russia three distinct but related objectives: namely, the extirpation of private property, the increase in physical productivity, and the creation of an environment suitable to the development and maintenance of communism.

Soviet farms are divided into three classes: (1) state farms *(sovhozi),* which are primarily utilized for demonstration purposes, although they furnish a convenient supply of grain for export purposes; (2) collective farms *(kolkhozi);* and (3) such individual operations as are still carried on. There are three types of the *kolkhozi,*[21] (a) the *tovarishchevstvo,* or comradeship farms, in which certain implements are owned in common; (b) the *artel,* in which farming operations are carried on collectively but in which the members live in their own houses and own their own consumption goods; (c) the *commune,* in which not only farming but living is done in a collective fashion. Of these forms the artel is the most dominant.

---

[21] "In recent years, *kolkhozi* have been the chief form of agricultural enterprise in the U.S.S.R. According to data for 1937, they produced 62.9 per cent of total agricultural output, State farms 9.3 per cent, homestead plots 21.5 per cent, workers' suburban plots 4.8 per cent, and individual independent peasants 1.5 per cent. In 1938, *kolkhozi* produced 86 per cent of all the grain, 30–35 per cent of all the livestock and animal products,

The communization of agriculture has not taken place as rapidly as the foregoing setup might indicate and certainly not as rapidly as has communization of industry. There are several reasons for this. In industry there already existed a small technical staff which could be called upon to assist the Soviet Government. Such a staff did not exist in agriculture. Again the Soviet Government found that it could readily employ foreign technical aid in industry but was unable to obtain from foreign countries persons with experience and ability to carry on the agricultural program. Hence, in carrying out the agricultural program many mistakes have been made. For example, many of the tractors for farming purposes were shoddily built, and no staff was available to make repairs at the farm, nor were there enough trained operators to run the tractors. As a result there were always, at least in the early stages of the program, a large number of tractors out of use. Another factor affecting the program was the suspiciousness of the peasants themselves, which resulted in a frequent killing and consuming of livestock. It was estimated that about one third of all of the livestock in Russia was lost after the agricultural program was announced. Several ludicrous attempts were made to overcome the meat shortage. For example, in or near many of the large cities rabbit farms were established. These enterprises, however, invariably failed because of the outbreak of disease for which there was no adequate control To overcome food shortage, other ambitious plans were un-

---

and 90–95 per cent of all cotton, sugar beet, flax, and oil-yielding crops." Bienstock, Schwarz, and Yugow, *Management in Russian Industry and Agriculture,* Oxford University Press, 1944, p. 137.

dertaken. In the case of wheat, more acreage was planted than could be cultivated, and yields fell disastrously. Also in the earlier years of the program inadequate crop rotation resulted in much damage from insect pests, plant diseases, and weeds.

It must be said, however, that at the present time things are moving much more satisfactorily. Livestock is increasing, and the government is making a strenuous effort to improve breeds of livestock by importing foreign stock. A trained personnel has been developed for the handling of the tractors and other farm machinery. The individual strips have been abolished, and thus much land that was formerly wasted has been put into cultivation. The system of paying for labor in the *kolkhozi* has been changed. Instead of day labor unadjusted for skill required on all tasks, the labor today is now adjusted for the various elements of the work.

Italy.[22] The origin of Farm Management studies in Italy is to be found in the early investigations of farm practices, aimed at the collection of data on input-output relationships, mostly by Vittorio Niccoli[23] and Oreste Bordiga.[24] Later, this work on farm practices developed into suggestions for better management and organization of the farm unit. At the same time, farm management data were collected in connection with the assessments for the farm property tax (Catasto).[25]

---

[22] The author is indebted to Dr. Victor B. Sullam for the material on Italy.

[23] Vittorio Niccoli, professor of Rural Economics at the Royal University of Pisa, published and constantly revised the *Prontuario dell'Agricoltore* (Farmers' Handbook), the standard reference for all Italian agricultural workers. New editions of the work were published every two years, thus keeping abreast of recent research.

[24] Oreste Bordiga, as professor of Agricultural Economics in several Italian universities, conducted research in farm management, wrote several books on agricultural economics, but left most of his work in the form of abstracts and outlines of lectures. For the early history of farm management in Italy, see Serpieri, Arrigo, *Economia Agraria,* Florence, 1937 (processed), and *Fra Politica ed Economia Rurale,* Florence, 1937.

[25] The *Catasto* is a government agency for the surveying, recording, and

An aspect of Italian agriculture which gives special significance to certain phases of farm management in Italy is the coöperative land-holding societies. These societies operate either on rented land or on coöperatively owned estates. Considerable farm management research has been done on these land-holding enterprises, assuming as a measure of profitability the *size of returns to the several families, members of the coöperative.* The more sober-minded economist cannot overlook the importance of these arrangements as phases of tenancy reform in which the advantages of large-scale farming are preserved and at the same time one rung is inserted in the agricultural ladder that might be profitably used for the educational development of tenants and farm hands in other lands. Thus, procedures developed in Italy for accounting, management, and contractual arrangements of coöperatives may be profitably studied.

Few other European countries have had significant independent developments. Problems relating to specific enterprises or parts of the farming system have received individual treatment, but advancement along that line cannot be strictly considered farm management research. Systematic accounting under government or private supervision, political economy, marketing problems, and technical problems have diverted scientific agriculturists from any attack on farm management as a specific study.

Questions

1. Describe briefly the nature of farm management work done prior to 1900.
2. Outline, giving dates, the development of the Federal Office of Farm Management and Costs.
3. Identify (a) Hays, (b) Hunt, (c) Spillman, (d) Warren, (e) Taylor, stating in each case the particular phase of the development with which he was connected.
4. Of what nature are the more recent developments in farm management?

---

assessing of real-estate property. The taxation of real estate is entirely based on returns, namely, on the rental value of urban holdings and on landlord's returns for agricultural holdings.

5. Describe briefly farm management developments in Germany.
6. On what farm management subjects has particular emphasis been placed in (a) England? (b) Switzerland? (c) Germany? (d) Russia? (e) Italy?

References

Bennett, M. K., *Farm Cost Studies in the United States.* Stanford University, California: Stanford University Press, 1928, Chapter I.

Cornell University, "An Agricultural Survey," by G. F. Warren and K. C. Livermore, *Cornell Bulletin No. 395.*

Holmes, C. L., "Farm Management," *Encyclopedia of the Social Sciences.* New York: Macmillan, 1931, Vol. VI, pp. 112–113.

Hoover, Calvin B., *The Economic Life of Soviet Russia.* New York: Macmillan, 1931.

Horner, J. T., "The United States Governmental Activities in the Field of Agricultural Economics Prior to 1913," *Journal of Farm Economics,* Vol. X, No. 4, 1928, p. 429.

Ilin, M., *New Russia's Primer.* Boston: Houghton Mifflin, 1931.

Orwin, C. L., "Cutting the Farmer's Costs," *Listener,* August 12, 1931.

Pagani, Mario, *Le Compartecipazioni Collettive del Mantovano,* Rome, 1935, and Sullam, Victor B., *Rapporti Tra Impressa E Mano d'Opera In Alcune Zone di Bonifica dell'Italia Settentrionale e Centrale.*

Roth, W. J., "Farm Accounting Investigations in Switzerland," *Journal of Farm Economics,* Vol. XIII, No. 4, 1931.

Roth, W. J., "Farm Budgeting," *Journal of Farm Economics,* Vol. XI, No. 4, 1929.

Stippler, H., "Philosophy of Aereboe as Related to Scope and Method of Research in Farm Management," *Proceedings of Western Farm Economic Association,* Fifth Conference, 1931.

Tofani, M., *Guida a Richerche di Economia Agraria, Economia della Bonifica Integrale,* and the whole group of publications of the *Biblioteca della Bonofica Integrale* (writings on land reclamation) published by Barbera, Florence. The whole of Serpieri's work is summarized in his *Calcoli Economici e Problemi Tributari nell' Agricoltura,* Barbera, Florence, 1940, which represents the foremost contribution of Italian economists to the study of farm management and fiscal problems of agriculture. This work is essential for an understanding of modern Italian farm management research.

Tolley, H. R., "Recent Developments in Research Method and Procedure in Agricultural Economics," *Journal of Farm Economics,* Vol. XII, No. 2, 1930, p. 213.

Tuckerman, G., "Applied Marxism in Soviet Russia," *American Economic Review,* December, 1933; *New Republic,* November 16, 1932.

U. S. Department of Agriculture, *Annual Report of the Office of Farm Management,* Fiscal Year Ending June 30, 1922.

U. S. Department of Agriculture, *Circulars 132, 135, 138, 139.*

U. S. Department of Agriculture, *Yearbook*, 1903, p. 369.

Von Frauendorfer, Sigmund, "Development Methods and Results of Agricultural Economic Research in the United States," *Journal of Farm Economics*, Vol. X, 1928, No. 3, p. 286.

Warren, G. F., "The Origin and Development of Farm Economics in the United States," *Journal of Farm Economics*, Vol. XIV, No. 1, 1932, p. 2.

CHAPTER IV

The Problems of Farm Organization

A COMMON criticism leveled against the farmer is that he does not organize and manage his farm in a business-like manner. As one observer has stated, the farmer is not a businessman and will only with difficulty become one.[1] This critic points out that the farmer does not keep books; he does not prepare a budget; he does not distinguish between personal outlays and outlays for crop and livestock expenditures. That the farmer fails to do these things is not surprising. As long as farming retains vestiges of self-sufficiency, it may be expected that farmers will be somewhat indifferent to the economic aspects of their business. Still, returns from farming are affected to a marked degree by economic forces; and the alert farmers, of whom there are a considerable number, may gain much in the way of enhanced returns by a careful study of the forces and conditions affecting the organization and management of their farms. The subject will be introduced by a discussion of the nature of the problem of organization, leaving those problems relating to management for subsequent treatment.

1. Organization Defined and Described

What is organization? It is well known that land, labor, and capital are all essential to the production of an economic good. These factors, however, are not productive unless associated and combined. Thus land by itself is not productive, until labor, seed, tools, machines, and often commercial fertilizers are used. Buildings of one kind or another must normally be available to house the tools, the machinery, and the commodities produced. Laborers must be fed, clothed, and provided with shelter. Arrangements must be made for the disposition of production after commodities have been brought into existence. In farming, this may mean the inclusion in the farm setup of various classes of livestock, as some farm products cannot be marketed in their original form. Or, in the event that the products can be marketed directly, it might be more profitable to dispose of them through livestock. It thus happens that to produce a *good* requires something else besides the three primary factors—land, labor, and capital. This something else is organization. *More specifically, organization refers to the arrangement of the various physical elements, and to the proportion in which these various elements are combined.* Organization obviously includes also the acquisition of various factors of production, the selection of the line or lines of production, the size of the business, and the choosing of the site or location of the farm with respect to the markets as well as with respect to the availability of the factors used in production. Then, too, there is the problem of checking on the results of production. This means that in setting up an efficient organization, provision should be made for records and accounts. In short, organization must provide for all of those things necessary to the production and marketing of a product.

---

[1] Seligman, *Economics of Farm Relief,* p. 94.

This complex thing which is called organization cannot, of course, come into being of itself. There must be some one individual or group of individuals who are responsible for the existence of any business organization. This responsibility cannot rest with the laborer, because laborers, as a rule, do not possess the necessary qualifications and in addition cannot, for financial reasons, assume the responsibility. The task falls to a rather definite class of individuals commonly referred to as business undertakers or *entrepreneurs.* The *entrepreneur* is the one who assumes the risks and receives any gains realized from a business.

2. The Selection of the Lines of Production

The selection of enterprises on a given farm will in general be governed by the law of comparative advantage. This law may be stated in terms of farming as follows: *A farmer, in order to use his available resources to the best advantage, will produce those crops or classes of livestock for which his farm has a relative advantage.*

There is considerable confusion as to the exact meaning of this law, because the word "relative" is apparently not always understood. Often the idea is expressed that comparison is made between the same crops in different areas or on different farms in the same area, but this is not the case. The comparison is made between different enterprises in the same area or on the same farm. An illustration or two will make the distinction clear.

Iowa farmers specialize in corn production, not because this crop can be produced more cheaply in Iowa than in some other section of the United States—although such may indeed be true—but because labor, land, capital, and management can be more effectively used in the production of corn than in the production of any other crop which may be grown. Even if it might be shown, for instance, that corn could be produced with less cost in the Cotton Belt, this fact would have no significance to the Iowa farmer because it is not the cost between areas that is significant but the relative cost of producing different products in the same area. Those crops which can be produced with less cost within the area will have first choice on the farmer's labor, land, capital, and management. Hence, Iowa farmers find it more profitable to devote as much time as possible to the production of corn and then to supplement corn production with other crops or classes of livestock for the absorption of any unused resources.

Another example may be given: It is generally conceded that cotton can be produced more cheaply in Texas than in North Carolina. From this fact it has been argued that

North Carolina farmers should not attempt to produce cotton but should grow other commodities. The idea is fallacious. While it may be true that Texas is in a more favorable position with respect to the production of cotton than North Carolina, the thing that North Carolina farmers are concerned with is the kind of crop or crops that might be grown in place of cotton. The question might be put in this form: What other crop or crops can the North Carolina farmer produce to a better advantage than he can cotton? If there is no other crop that can be grown more profitably than cotton, then the farmers in North Carolina will continue to produce cotton even if the cost is higher than in Texas. In other words, what it costs to produce cotton in Texas has little or nothing to do with whether or not farmers in North Carolina will grow cotton. Unless the acreage of cotton in Texas is sufficient to grow all of the cotton required for the world consumption at a price so low that cotton production in North Carolina would not cover direct costs,[2] there is no point in comparing the costs of producing cotton in Texas and in North Carolina. In the event that Texas could produce all of the cotton required, at a price so low that cotton in other sections of the Belt would be reduced to a position where some other crop would be more profitable, then the cotton production in Texas would have some significance to the farmers in other areas. It is evident, of course, that any expansion of cotton production in Texas may reduce the net income of cotton farmers in other sections of the South. But until cotton production becomes so great in Texas and cotton prices become so low as to make cotton of secondary importance to farmers in other sections of the South, they will continue to grow cotton as their principal crop.

Specifically, the decision of the farmer with respect to the

---

[2] The term "direct cost" as used here means those costs which are incurred in the production of specific crops, such as fertilizer, seed, and hired labor. Fixed costs, such as land, building, and family labor, are not included.

Illustrations from Bu. Agr. Econ.

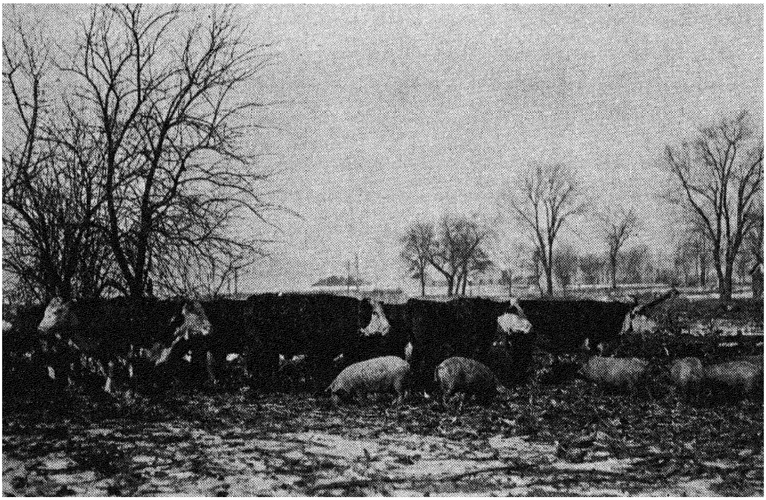
Fig. 7. One of the most important problems of organization is the selection and combination of farm enterprises.

selection of lines of production to be included in his farm business will be influenced by the following factors:

a. **The amount and character of his available resources.** In some cases the quality of the land may be the important factor affecting choice of lines of production. In some situations the amount of labor supply may be more important than land or any other factor. Or, it may be that equipment is the limiting factor. These may be, as will be pointed out later, interdependent. That is, the nature of the land may affect the use of machinery and labor, but here emphasis is placed on the extent or availability of any or all of the farmer's resources.

b. **The nature of the physical condition.** The physical factors of soil, topography, temperature, and rainfall affect the choice of farm enterprise. It is now well known that some soils are much better adapted than others to the production of particular crops. It is one of the tasks of the entrepreneur to know just what the soil requirement of each crop is and to make the best soil-crop adaption that the circumstances permit. In a similar manner, the temperature requirement of crops and the various classes of livestock must be studied before the various lines are chosen. Topography affects the choice of crops largely through its effect on the type of machinery which may be used, although there are other things to be taken into consideration. For example, topography obviously affects air drainage, and this, in turn, affects the crops which may be produced.

c. **Relation between enterprises.** A factor of major significance in determining selection is the relation between enterprises. Some enterprises compete or conflict for the resources of the farmer. Such enterprises are known as *competing enterprises.* Other enterprises may require the same resources but not all at the same time. These may be called *supplementary* or *noncompeting enterprises.* But this is not the end of the problem. Enterprises may possess certain features which make them valuable in that



Courtesy of University of Illinois Agr. Exp. Sta.

Fig. 8. The feeding of steers and hogs in the same feed lot illustrates the complementary relationship of farm enterprises.

they contribute, or may be made to contribute, to the productiveness of some other enterprise. When enterprises possess this feature, they are known as *complementary enterprises.*

(1) *Competitive Relations.* Agricultural economists, in discussing the nature of competition among enterprises, usually emphasize competition for labor. But the fact should not be overlooked that enterprises may conflict also for land and capital. Competition for land arises out of the obvious fact that two crops cannot, as a rule, be grown on the same land at the same time. Competition for labor becomes a matter of considerable concern if the peak load or demand for any two or more crops comes exactly at the same time.

(2) *Supplementary Relations.* Farm enterprises may be supplementary with respect to all of the factors, which is not common, or supplementary with respect to one fac-

tor. A few examples will be given to emphasize the nature of the relationship.[8]

Land: (1) It is characteristic of some plants to feed deeply while others tend to be shallow feeders. If deep and shallow rooted crops can be grown in rotation, it is possible to secure a better utilization of the various elements of plant food. (2) Plants differ as to percentage of the various elements in plant food which they utilize. A better utilization of all the available elements may be brought about if crops which have different plant food requirements can be grown in rotation. (3) When two or more crops can be grown on the same land at the same time, there may result a more complete use of the land. This may sometimes be true when a young orchard is planted to truck crops. The production of truck crops does not, as a rule, interfere in any way with the development of the trees, and on the contrary their cultivation may reduce the cost of developing the orchard. (4) In some areas two crops may be grown on the same land at different times in the same season. For example, in the cotton belt, soybeans or cowpeas may follow oats cut in June.

Labor: (1) The addition of certain enterprises to the farm may be a means of utilizing labor more effectively. The inclusion of dairy cattle, for example, may provide a better utilization of family labor. The dairy herd might not be profitable if all the labor had to be hired. However, when the labor is furnished by the farmer's family, the dairy herd furnishes a means of marketing the family labor. (2) A wood crop added to the system of production may utilize more completely the farm labor and equipment, as such a crop can be harvested when the labor and equipment are not required for field crop or livestock production. (3) The cleaning and disinfecting of seed on the farm during the winter in preparation for planting in the spring would be a supplementary activity. In this same category would also fall the care and repair of machinery and buildings during the slack periods of the year.

Buildings: As a general rule, the main or principal farm buildings may be used jointly by several crop and livestock enterprises. If the farm organization is highly specialized it may mean that some of the building space is not used at all or only part of the year. It is sometimes possible under such conditions to include in the farm organization an enterprise without incurring at the same time any extra building costs.

Machinery: The addition of a crop to the farm organization may, in some instances, utilize to a better advantage the farm machinery. This is especially true of farm machinery which is not highly specialized, as harrows, plows, and discs. The addition of one or more crops to the farm organization may, therefore, effect a better utilization of such implements and machines.

---

[8] Gray, *Agricultural Economics*, pp. 129–132.

(3) *Complementary Relations.* It has been stated that when one enterprise contributes to the productiveness of another, the relationship is complementary. The nature of this relation may be made clear by a few illustrations:

(a) Crop and livestock may be complementary: (1) It is often feasible to add livestock to the farm organization for the purpose of utilizing unmarketable products, such as roughage, pasturage, damaged grain, or other crops which ordinarily cannot be directly marketed at a profit. (2) One type of livestock may be added to the farm for the purpose of consuming products which otherwise would be wasted by another class of livestock. Hogs are often added to the farm for the purpose of utilizing the corn wasted by steers when the steers are being fed in the dry lot. (3) Again, one class of livestock may be added to the farm to consume the product of some other enterprise. An illustration of this is found when hogs or poultry are added to consume skim milk produced on farms where cream or butter is sold. (4) When livestock is the main enterprise on a farm, manure is a by-product. When this is the case, it may pay the farmer to use the manure in growing crops which it would not pay him to grow if the manure were not available.

(b) One crop may be complementary to another crop: (1) Sometimes legumes aid in the production of other crops by adding nitrogen to the soil. Wheat is often used as a nurse crop. (This relationship, it should be noted, is also supplementary, as two crops are being produced on the same land and at the same time, thus utilizing to a fuller extent the factors of production.) (2) Seed from one crop may be used for subsequent crops. (In part this is also a supplementary relation in that the preparation of the seed for the next year's growth utilizes labor which would otherwise not be used.) (3) Grain may not be profitable unless grown in rotation with tilled crops. By the introduction of tilled crops weeds are reduced, thus improving the quality and the yield. The fertility of the soil is also conserved, or even increased by this practice. (4) Loss due to insect pests or plant diseases may be prevented by adding crops to the farm organization and by establishing a definite rotation. In fact this is one of the main reasons for a systematic crop rotation.

(4) *By-Products.* In this connection, the importance of by-products should be emphasized. In some instances, by-products may be disposed of in their native form, in which case they do not involve other enterprises, but as a rule they must be transformed before they can be sold. This means that the farmer must add some other enterprise, usually livestock, in order to convert by-products. Not

infrequently farmers overlook the possibilities of such conversion. In many instances, no doubt, they have been deceived by the contribution of by-products to the net farm income as determined by the use of inadequate or faulty cost accounting methods. For example, it is the frequent if not the common practice for farm cost accountants to charge such by-products as straw and skim milk to a livestock enterprise at "a market price," or a market price less deductions for freight or cartage. In other instances, these by-products have been charged to a livestock enterprise at their cost of production, the cost being calculated by using the same cost rates for the by-products as for the main or principal product. Both methods may be wrong. But as a result of these accounting practices, the livestock enterprise may appear "unprofitable," when as a matter of fact the livestock enterprise is making a substantial contribution to the net farm income. It is always, or almost always, desirable to convert by-products when any appreciable returns over and above the prime cost of conversion are likely to be realized.

d. **Market demand as reflected in the relative prices of farm products.** It is the relative prices of farm products and not their absolute prices which are important in selecting enterprises. When price is the only consideration in choosing lines of production, an absolute uniform rise or fall of all commodities is of no particular significance in selection. Such a rise or fall will, of course, affect the net income but will not constitute the basis of selection. But when the prices of some commodities rise or fall more rapidly than others, such phenomena are of importance. Other things being equal, the entrepreneur will do well to select those commodities which tend to rise most rapidly, or in the case of falling prices to select those commodities the prices of which fall least rapidly. The movement in prices, then, is a subject which must be given particular attention by the entrepreneur if a wise choice of enterprise is to be made. Not only is this true, but such a study is essential if the enterprise combination is to be adjusted quickly with the changes in the relative prices of farm products.

e. **The distance from market and the type of transportation facilities available.** These are factors of supreme significance in the selection of crops and classes of livestock. They express themselves largely through the cost of transportation. Some farm crops, because of the excessive cost of transportation, must be converted into livestock products. When this is the case, the choice of enterprise must of necessity involve various types of livestock. But the effect of cost of transportation may not be confined to those crops which must be converted into livestock products. It affects also the choice of all crops, as each crop varies with respect to such things as bulkiness and perishability, and these affect the cost of transportation. It is essential then to know what transportation costs are or are likely to be and how these costs will affect the return from both crop and livestock products before making the final selection of enterprises to be included in any given enterprise combination.

f. **The risk involved.** Each line or continuation of lines must be viewed from the risks involved either from variations in yields or from variations in prices.

g. **Personal factors.** The farmer will and should give some consideration to his own peculiar fitness for the production of the various lines open to him and also to his likes and dislikes.

3. The Combination of the Factors of Production

This is a problem of paramount importance. It is a problem which every entrepreneur has to face, and the manner in which it is solved determines to no small extent the success of the business. The problem is a difficult one because it involves technical practices and economic principles. The problem of combining the factors is usually emphasized in the case of the individual enterprises. Such considerations as the amount of fertilizer that should be used per acre, the number of times corn should be cultivated, or the quantity of feed that should be used per unit of livestock, all relate to the combination of the several factors. The combination of the various factors that appears "best" when viewed from the results obtainable from a single enterprise may not be the best when there are several enterprises all competing for the use of the available factors. The farmer may find that it will pay to skimp on one enterprise and use the factors more freely on some other enterprise. It is for this reason that the results from experiments conducted on a single enterprise are often misleading. In many cases the farmer will reject, and rightly, the advice of the technical expert, because he finds it better to utilize a particular factor in some other way than that recommended.

In combining the several factors, either in the production of a given crop or livestock product or in projecting the production for the farm as a whole, the farmer will be influenced by: (a) the quantity and quality of those factors over which he has control, (b) the relative cost of those factors, (c) the prices or anticipated prices of the resulting products, and (d) the various minimum technical requirements. If the farmer is short on land, for example, and cannot obtain additional acreage, he may find it necessary to increase some other factor or factors, such as labor and fertilizer. Or, if the cost of land is relatively high, he may find it advantageous to use more of the other factors on relatively few acres. The particular combination will also be influenced by the price of the product; that is, the combination of the several factors will probably be changed as the prices of the resulting products change. Finally, the minimum technical requirements will affect the combination. In many instances there are minimum requirements in feed, seed, and fertilizer, below which it does not pay to go.

The best results will be obtained if the farm business is so organized that production can be kept adjusted to the anticipated market demands. That is to say, the whole business must be organized so that an increase or a decrease in production can be made at the proper time and at a relatively low cost. This is a management problem; but an organizer must set up an organization that can be operated at different capacities, without involving too many radical changes in the organization as a whole. In industry this problem is sometimes met by dividing the whole establishment into definite units, each unit being an independent one insofar as the production processes are concerned. If a decrease is desirable, one or more units may be shut down. Or, again, the machines may be run at different capacities. Whatever methods or particular means are employed, *flexibility* in production must be provided for. Flexibility may be attained in several ways. One way is to organize the farm on what has been called the *unit system*. Taylor describes this system as follows:

> On the great wheat fields in California the unit may be based upon the combined harvester and thresher. This machine, the crew to operate it, and the land, men, horses, and other equipment required to raise that amount of wheat which can be cut during the normal harvest period may here make up the unit of organization. In the Corn Belt of Central Illinois, where corn is the principal source of income, one man and a team of from two to four horses, a plow, a harrow, a corn planter, and a corn cultivator suited to the horse power decided upon become the basic unit of organization. This same unit, with the addition of a grain seeder, a binder, and a mower will care for oats and hay in combined amounts equal to the area of corn handled. The area of corn which this one man and equipment can prepare the land for, plant, and keep clean for subsidiary purposes, becomes the unit of economic farm organization. One or many of these units may make up a given farm, depending upon the managerial ability of the farmer, the conditions in the household, and the size of the family labor force. In the Corn Belt a farm which will not employ one unit is clearly too small. To be of proper size the farm should make demand for one, two, three, or more of these units, but should not fall halfway between. A farm which is too large for one man and too small for two cannot be economically organized for corn production.[4]

Other ways than the unit system are open to the farmer. He may often use machines which are not highly specialized; that is, these machines may be used for more than one purpose so that a change in production need not involve a radical change in equipment. Instead of using one large machine, he may use two or more of the same design but of smaller capacity. These smaller units can be added or abandoned, depending on whether or not production is to be increased or decreased. Buildings may be of such construction as to be readily adapted to changes in production. The cropping system may be made flexible by substituting a short rotation for a rotation which extends over a long period of time. The livestock production may be projected on a basis which will permit a decrease or an increase in relatively short periods. Whatever may be the means employed, the organization must be flexible in order that adjustments in production may be made in anticipation of changing market conditions.

---

[4] Taylor, *Outlines of Agricultural Economics*, p. 175.

4. Market Connections and Information

While not all goods produced on the farm are sold, there is in the case of most farms a sufficient volume of sales to make it well worth while for farmers to establish market outlets for the things to be sold. This does not mean that a sales contract is necessary, although there is often one. It means that the farmer should have a knowledge of market conditions—the trend in production, the demand for the various agricultural products, and other market information which normally affects the production and disposition of farm products. Market connections for the things he has to buy are also important. He should know the approximate cost for which he can obtain his labor, seed, fertilizer, and other cost goods.

5. The System of Records and Accounts

The successful operation of a business of any considerable size requires a knowledge of present and past performances. This knowledge is best acquired not by depending upon the memory of those charged with the task of operating the business but through a day to day systematic recording of all important activities. On large farms this may mean production records not only by enterprises but also by individual workmen. It may also mean time or machine records for the purpose of determining how long it takes an individual workman or a machine to do a certain operation. A record should be made of all receipts and expenditures not only on the business as a whole but by subdivisions of the business, such as departments or enterprises. These are not solely for the purpose of showing the loss or gain for the business but for the purpose of determining where losses were incurred or where gains were made in order that the proper steps can be taken to remedy any evident defect in the operation or organization of the business.

The need for adequate records and accounts is generally recognized in commercial and industrial business, but the vast majority of farmers keep meager, if indeed any, records of business. Records and accounts, however, are essential to the successful operation and organization of a farm. Farm records and accounts, when properly conceived and kept, may be made to show: (a) what lines of production it will pay best to follow, (b) how to organize the lines of production so as to utilize to the best advantage the factors of production, (c) how to aid in making adjustments, and (d) what information may be used in increasing efficiency. These do not, by any means, exhaust the use to which the data collected by accounting may be put, but they do indicate the necessity for the provision of an adequate system of records and accounts if the farm is to be run in a businesslike manner.

Questions

1. What is organization? What general problems are included in this category?
2. Define *entrepreneur,* and explain the functions of an entrepreneur in agriculture.
3. State the factors influencing the choice of enterprises.
4. Why should each farm have more than a single enterprise?
5. What particular difficulties are encountered by the farmer of

today in the acquisition of each of the four major factors of production? Explain why these problems have become increasingly difficult in the last half century.

6. State the general influences affecting various combinations of the factors in an enterprise.

7. Describe what is meant by the unit system.

8. Explain the importance of market connections.

9. What should a properly conducted system of records and accounts show? Of what value is such a system to a farmer?

References

Adams, R. L., *Farm Management.* New York: McGraw-Hill, 1921, Chapters III, IV, and V.
Black, J. D., *Production Economics.* New York: Henry Holt, 1926, Chapter XVI.
Boss, Andrew, *Farm Management.* New York: Lyons and Carnahan, 1923, Chapters VII and VIII.
Carver, T. N., *Principles of Rural Economics.* Boston: Ginn, 1911, Chapter IV.
Gray, L. C., *Introduction to Agricultural Economics.* New York: Macmillan, 1924, Chapters VIII, IX, and X.
Holmes, C. L., *Economics of Farm Organization and Management.* Boston: Heath, 1928, Chapters V and XIV.
Seligman, Edwin R. A., *Economics of Farm Relief.* New York: Columbia University Press, 1929.
Taylor, H. C., *Outlines of Agricultural Economics.* New York: Macmillan, 1931, Chapter V.
U. S. Department of Agriculture, "Relation of Land Income to Land Value," by Clyde R. Chambers. *Bulletin 1224.*

CHAPTER V

Selection and Combination of Farm Enterprises—General Principles

TWO related questions are involved in selecting farm enterprises: (1) What enterprises should be selected? and (2) How should these be combined in order to utilize the available resources to the best advantage? These two questions are the theme of this chapter.

1. Methods of Selecting Enterprises

The *gross value* per acre has been advocated as a basis for selecting crops. That is, of two crops, the one which gives the largest gross income should be selected. There is something attractive about this idea. Since the gross value is large, the faulty conclusion is reached that the net returns per acre must also be large. But a moment's reflection will be sufficient to show that this is not necessarily the case, for the expense of production may also be large. Table 1 shows, for example, the relation of gross income to net income per acre. In some cases the gross income per acre is large but the net income relatively low. In short, there is no necessary relation between gross and net income. Hence, gross value per acre is not likely to be a satisfactory basis of selecting farm crops.

The *net return* from the enterprises has been suggested as the proper basis of selection. That is, the important thing is not gross return but net return. However, when an attempt is made to apply this measure, certain difficulties arise. First, it is difficult to calculate the net return accurately. The value of many of the cost elements, such as

TABLE 1

RETURNS IN ROUND NUMBERS OF SELECTED CALIFORNIA CROPS FROM 20 ACRES[a]

Crop	*Gross Returns*	*Sum over Operating Costs*	*Per Cent Net Is of Gross Returns*
Orange	$6,900	$2,300	33.33
Walnut	6,200	4,000	64.51
Prune	9,600	6,800	70.83
Peach	7,800	5,300	67.94
Pear	7,500	2,600	34.66
Rice	2,750	1,300	47.27
Sugar beets	2,700	1,500	55.55
Grain sorghum	720	280	38.88
Wheat	500	260	52.00
Sweet potatoes	3,600	1,700	47.22
Tomatoes	4,600	1,250	27.17
Potatoes	2,200	680	30.91

---

[a] Adams, R. L., *Farm Management*. New York: McGraw-Hill, 1921.

family labor, has to be estimated; and this, in many instances, is a difficult if not an impossible task. True, this difficulty largely disappears if the cost elements are used in approximately the same proportion for any two enterprises. But, even assuming that the cost can be calculated accurately, there are other things which must be considered. One enterprise may be more profitable than another in terms of money, but the less profitable one might have certain supplementary or complementary features not possessed by the enterprise which appears to be the more profitable one. This may mean, of course, that the returns have not been calculated properly because of the accounting practice employed. That is, in the calculation of returns the supplementary and complementary features have been ignored in adjusting the cost rates.

In Table 2 are represented data showing the returns per acre and the returns per man hour for oats, corn, and tobacco. If choice were to be made on the basis of net returns per acre, oats would be eliminated. That is, the net return per acre for oats is $6.90 as compared with $18.50 for corn and $48.50 for tobacco; but, if the oats were elim-

TABLE 2

NET RETURNS PER ACRE AND PER HOUR OF MAN LABOR FROM OATS, CORN, AND TOBACCO ON A WISCONSIN FARM [a]

Crop	*Net Return per Acre*	*Net Return per Hour of Man Labor*
Oats	$6.90	$ .27
Corn	18.50	.75
Tobacco	48.50	.41

---

[a] *Journal of Farm Economics*, Vol. 5, No. 2, p. 68.

inated from the farm organization, no doubt the net returns from the farm as a whole would be less. The reason for this is not difficult to discover. The oat crop at no time during the year seriously conflicts with either of the other two crops. In reality, then, oats supplement corn and tobacco production. That is, by growing oats, even if they are less profitable than corn or tobacco, resources are utilized at a time when they are not needed for the production of the other two crops.

Nor is this all. Complementary features may also render the net return per unit, as normally computed, invalid. Some enterprises may have by-products which would be of no value unless utilized on the farm. A good illustration of this is found in dairy production in areas removed somewhat from large cities. The manure produced by the dairy herd is a by-product and may be used in the production of crops which would not normally be grown unless manure were available. These crops may add materially to the net income of the farm as a whole. Evaluating the manure in such cases would indeed be a difficult task, and normally such an evaluation is not worth the trouble involved.

Other illustrations could be given to show the inadequacy of net returns as a basis for enterprise selection. The difficulty arises, as suggested above, largely out of the method of accounting used. It is often impossible to evaluate properly the various cost elements, with the result that net returns do not reflect the relative profitableness of an enterprise. In the examples of oats, corn, and tobacco cited above, no doubt the labor for all of these crops is charged at the same rate, but evidently this is not fair to the oat enterprise. If the labor were not used on oats, it probably would not be used at all. Some adjustment in the labor rate is evidently needed, but normally it is not made. Hence, the net returns cannot be used in selecting enterprises, except where the enterprises are competitive and have the same complementary features.

Net returns per unit multiplied by the number of units one man can operate appears to some a more reliable basis of enterprise selection than the net returns per unit. This idea arises out of the fact that whereas one enterprise may indeed be more profitable than another, it may also be true that more units of the less profitable enterprise can be produced per man, and thus, for the two to be reduced to a comparable basis, the net returns per unit in each case should be multiplied by the number of units one man can operate. If one man can operate 5 acres of tobacco or 40 acres of corn, then the net returns per acre should be multiplied in the case of tobacco by 5 and in the case of corn by 40, or, what amounts to the same thing in this case, the returns for corn per acre should be multiplied by 8. For example, in Table 2, the net return per acre for corn is $18.50 and for tobacco $48.50. If $18.50 is multiplied by 8, then the basis of comparison would be $148.00 for corn and $48.50 for tobacco. Evidently corn is more profitable than tobacco.

But the assumption that for each acre changed from tobacco, corn can be increased 8 acres does not square with the facts. While it may indeed be true that a given farmer could operate 8 acres of corn for each acre of tobacco, in any given case a reduction of 1 acre of tobacco cannot be accompanied by an increase of 8 acres of corn unless the farmer increases the size of his farm. Normally a reduction of one acre in one crop means an increase of one acre in some other crop. To increase the size of the farm in order to grow more corn in place of tobacco is not so much a problem in selection as it is in determining the size of the farm. The problem of the size of the farm is somewhat different from that of the selection of enterprises although, as will be pointed out later, the two problems are, of course, related.

Furthermore, this method does not eliminate the difficulty of determining net returns raised in the preceding discussion. Nor does it take into consideration the possibilities of supplementary or complementary features which one crop may possess. Thus, for example, corn may be fed to livestock, and the combination of corn and livestock may be more profitable than either one alone. One crop, such as tobacco, may conflict with some other crop, such as the small grain, whereas corn would be supplementary. Furthermore, the effect of corn-livestock combination on soil fertility would be a factor affecting choice. Obviously net returns per unit multiplied by the number of units one man can operate is not a reliable method to use.

The *net returns per hour or day of man labor* has been advanced as one of the most satisfactory methods of selecting enterprises. This means, of course, that of two enterprises the one returning the highest net returns per hour of man labor should be chosen. Aside from the fact that the problem of calculating accurately net returns still remains, this method overlooks the fact that there is considerable variation among enterprises with respect to their demand on the resources of the farmer. Two enterprises might, indeed, return two different rates per man hour or per day, and if these two enterprises did not seriously compete for the time or other resources of the farmer, it would undoubtedly be advisable to include both in the enterprise combination of the farm.

An example of the error which is likely to be made in using the net return per man hour as a basis of selecting enterprises is illustrated by the data in Table 3. This table shows that on the basis of returns per day for man labor,

TABLE 3

Returns per Man Hour in the Case of Cotton and Corn [a]

Cotton			*Corn*	
Credit			Credit	
By cotton, 414 lb. lint @ 19.4¢	$80.32		By pork, 457 lbs. @ $10.20	$46.61
By cotton, 735 lb. seed @ 1.5¢	11.02	$91.34		
Debit			Debit	
To cost of production (Cost of ginning not included) Including 15.15 days man labor		54.42	To cost of producing corn $22.41 To cost of supplement 5.44 Including 3.73 days man labor	$27.85
Profit per acre		36.92	Profit per acre	$18.76
Profit per day of man labor, $2.44			Profit per day of man labor,	5.02

The labor devoted to the production of one acre of cotton was sufficient to produce four acres of corn.

The value of the manure ($7.42) is considered ample return for the labor of feeding the hogs.

---

[a] *North Carolina Extension Folder,* No. 26.

corn, when fed to hogs, is more profitable than cotton, when cotton is worth 19.4 cents and pork 10.2 cents per pound. The return per day of man labor on cotton is $2.44, as against $5.02 for corn when fed to hogs. Do these data mean that corn and hogs should replace cotton? The question, of course, must be answered in the negative. Cotton and corn can both be produced on the same farm. They conflict to some extent, but not seriously. It will be noted that on the acre basis cotton is more profitable than corn. Assuming that for each acre cotton is reduced, an acre of corn is substituted, it is obvious that the net returns from the farm will be reduced as cotton is eliminated. The labor required to produce one acre of cotton in this case is sufficient to produce four acres of corn. This does not mean anything unless the farmer can increase the size of his farm; but, as already observed, this is a different problem.

2. The Problem of Allocating Farm Resources

From the foregoing discussion it is evident that there is need for a statement of the principles involved in enterprise selection. It should be remembered that the farmer has the task of using his resources (land, labor, equipment, and management) so as to get the maximum net returns from the farm as a whole. To do this, he must combine the enterprises which are to comprise this organization in such a manner that the marginal net returns from each unit of resources shall be approximately equal irrespective of the enterprise upon which the unit is expended. If enterprises are not combined in this manner, the maximum net returns from the farm as a whole will not be obtained. Hence, the major objective in combining farm enterprises should be to distribute the various resources in such a manner that the returns from the marginal expenditure on each enterprise will be approximately equal.

This principle may be better understood if reference is made to the basic law of diminishing returns. In Table 4 are presented data derived from an actual experiment, the object of which was to determine how the production of cotton would be affected by increasing applications of a mixed fertilizer. In Column 1 are the inputs of fertilizer per acre; and in Column 2, the outputs of seed cotton in pounds. These first two columns give the factual basis of the experiment from which data in the remaining columns are derived.

For the purpose of this discussion the output has been expressed in values by multiplying the cotton poundage by 10 cents per pound. The results of this multiplication are shown in Column 3. In Column 4 is given the value of the added cotton produced from additional inputs of fertilizer. For example, in Row 0, Column 4 is $50.00, which means that this is the value of cotton over no cotton at all; whereas

TABLE 4

The Effect on Returns from Cotton When an Attempt Is Made to Increase Production by the Application of Fertilizer [a]

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Inputs of Fertilizer (Unit 100 lb.)	*Outputs of Seed Cotton per Acre (lb.)*	*Value of Output @ 10¢ per Pound*	*Additional Value of Cotton*	*Cost of Fertilizer @ $40 per Ton*	*Additional Cost of Fertilizer*	*Value of Cotton Less the Cost of Fertilizer (3–5)*	*Successive Net Returns (4–6)*
0	500.0	$50.00	$50.00	$0.00	$0.00	$50.00	...
1	615.0	61.50	11.50	2.00	2.00	59.50	$9.50
2	719.0	71.90	10.40	4.00	2.00	67.90	8.40
3	812.5	81.25	9.35	6.00	2.00	75.25	7.35
4	895.5	89.55	8.30	8.00	2.00	81.55	6.30
5	969.5	96.95	7.40	10.00	2.00	86.95	5.40
6	1,037.0	103.70	6.75	12.00	2.00	91.70	4.75
7	1,096.0	109.60	5.90	14.00	2.00	95.60	3.90
8	1,148.5	114.85	5.25	16.00	2.00	98.85	3.25
9	1,195.0	119.50	4.65	18.00	2.00	101.50	2.65
10	1,235.0	123.50	4.00	20.00	2.00	103.50	2.00
11	1,269.5	126.95	3.45	22.00	2.00	104.95	1.45
12	1,299.0	129.90	2.95	24.00	2.00	105.90	.95
13	1,324.0	132.40	2.50	26.00	2.00	106.40	.50
14	1,344.0	134.40	2.00	28.00	2.00	106.40	.00
15	1,360.0	136.00	1.60	30.00	2.00	106.00	–.40
16	1,372.0	137.20	1.20	32.00	2.00	105.20	–.80

---

[a] Adapted from *South Carolina Experiment Station Bulletin Number 219.*

in Row 1, Column 4 is $11.50, which is the increase in value of cotton produced, when the first 100 pounds of fertilizer is applied, or the difference between $50.00 and $61.50. All of the remaining items in Column 4 are derived in a similar manner. The cost of fertilizer is shown in Column 5. This cost has been obtained by multiplying the data in Column 1 by $2.00, or at the rate of $40.00 per ton. The additional cost of fertilizer is shown in Column 6 and is constant at $2.00; that is, each additional unit of fertilizer costs the same amount. The difference between the gross value of cotton as given in Column 3 and the total cost of fertilizer as given in Column 5 is the net value of cotton above the cost of fertilizer. These data are given in Column 7.

For example, in Row 0 the value is $50.00 because no fertilizer has been used, but in Row 1 the result is $59.50, which is derived by subtracting $2.00, the cost of fertilizer, from $61.50, the value of cotton produced. The same procedure is followed in obtaining the data in all of the other rows of Column 7. Finally, the data in Column 8, the successive net returns, are obtained by subtracting the data in Column 6 from those in Column 4.

The essential parts of the information presented in Table 4 are shown in Figure 9. The units of fertilizer (the variable factor) are plotted from the horizontal axis; and the values, from the vertical axis. There are three curves: the first one, or the gross-value curve, is obtained by plotting the data in Column 3 against the data in Column 1; the second curve is the net-value curve, and this shows the coördinate points of data in Column 7 and Column 1; and the third, or successive net-value curve, is shown on an enlarged scale in order to make it somewhat more legible. This curve shows the diminishing net values as an attempt is made to increase the production of cotton when the land area is fixed.[1]

The question may be asked, "How far would it pay a farmer, operating under these conditions, to apply fertilizer in the production of cotton?" In this case the only cost considered is that of fertilizer. This being so, it is evident that the farmer will be justified in applying not more than 14 units of fertilizer to each acre. It is this amount which gives the maximum net returns, and it is at this point also

---

[1] A more accurate method of determining the most profitable amount of fertilizer to use is to compute the marginal costs of fertilizer This is accomplished by dividing the added cost of fertilizer by the added output of cotton. When the marginal cost, computed in this fashion, is equal to the price per unit of output, the net returns are at a maximum. For example, the added output for the 13th combination is 20 lbs. (1279–1259). This amount divided into the added cost of fertilizer, which is $2.00, is equal to 10 cents, which is also the price per unit of the output. The net returns also reach their maximum at this combination. The use of this method avoids the possibility of two combinations giving identical results, e.g., combinations 13 and 14, Table 4.

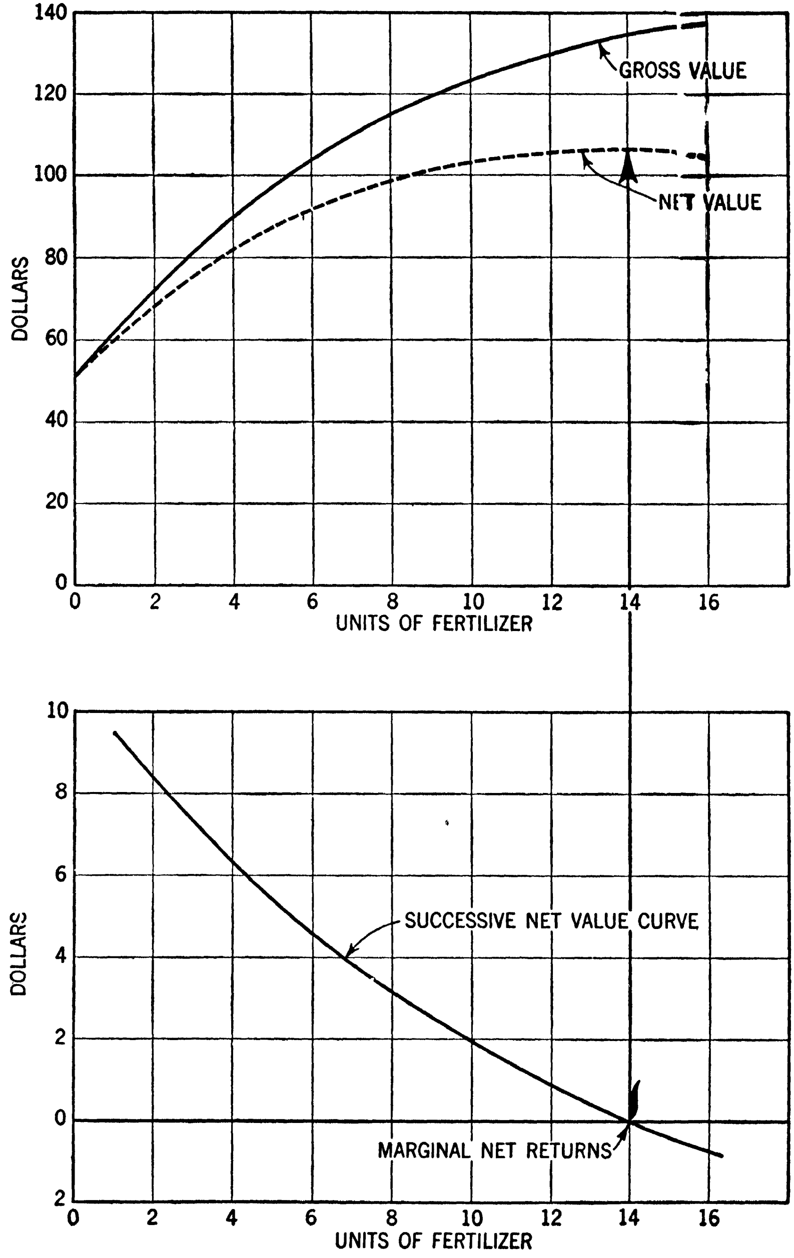


Fig. 9. The effect on gross and net returns from one acre of cotton when an attempt is made to increase output by the use of additional applications of commercial fertilizer.

that the added value of cotton is equal to the added cost (compare Column 4 and Column 6, Row 14). Hence, the maximum net returns are obtained when the added value is equal to the added cost.

3. Rules for the Allocation of Farm Resources to Various Farm Enterprises

The problem of allocation, however, becomes more difficult when several enterprises compete for the use of the farmer's resources. When this occurs, the principle of equimarginal returns must be applied. This means that, instead of using units of resource until the last unit applied just pays for its use, as would be the case with a single enterprise, the units must be so allocated that the net returns from each unit used is the same.

In the application of this theory to the selection and combination of farm enterprises, the following rules apply. These rules are demonstrated in Figures 10 to 12 inclusive, which have been constructed in a similar manner to Figure 9.

Rule 1. *When there is one enterprise that is clearly more profitable than any other, develop this enterprise to the limit permitted by the available resources.*

This rule is illustrated in Figure 10. The vertical scale represents the net value of additional returns; the horizontal, the units of resources used in production. It is assumed that the resources are fixed. The symbol E_1 represents the enterprise that is clearly the most profitable of a number of enterprises available to the farmer. The line E_1 E_1 is drawn in accordance with the theory that with each added unit of resource the marginal returns decline. If under the assumed conditions an attempt should be made to include in the farm organization any other enterprise, say E_2, the total net returns would be less than if the resources were used solely in the production of E_1. In the case of enterprise E_2, the first unit of resources would be less productive than the last unit used on E_1. It is clear then that a farmer

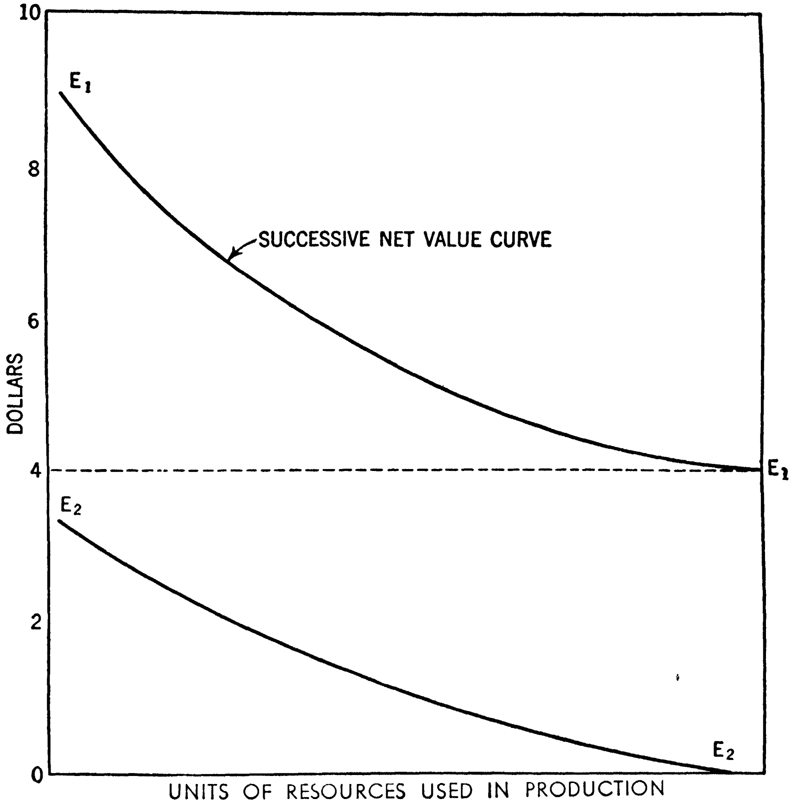


Fig. 10. How the farm resources will be used when one of a number of competing enterprises is clearly the most profitable.

should not attempt to introduce into his organization an enterprise such as E_2 but should concentrate on the production of E_1.

Rule 2. *If, in any given case, an enterprise is not clearly the most profitable, the addition of supplementary enterprises may involve some reduction in the major enterprise below the maximum permitted by the available resource. When this is the case, adjust the enterprises as long as the net returns from the farm as a whole increase.*

Rule 2 is illustrated in Figure 11. In this case both enterprises E_1 and E_2 may be expanded to the maximum, that

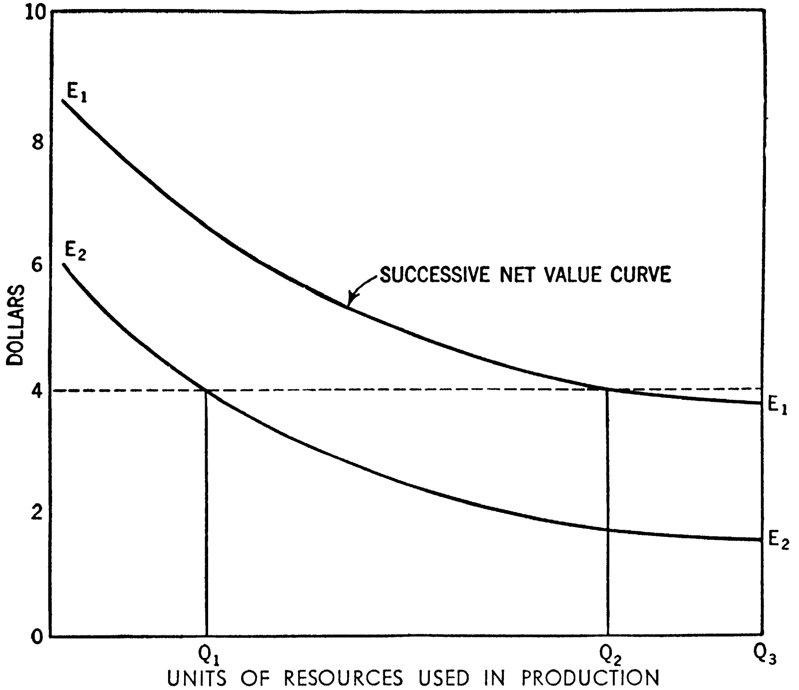


Fig. 11. How the farm resources will be used when two or more enterprises are partially supplementary.

is, up to the point when all of the fixed supply of the resources is used. But the problem is to distribute the available supply of resources between these two enterprises so as to get the maximum net returns. The problem is solved by using OQ_1 resources on enterprise E_2 and OQ_2 resources on enterprise E_1. It will be observed that OQ_1 plus OQ_2 is equal to OQ_3, or the total resources available. There is no other distribution of the resources which will give equal marginal returns and, consequently, none which will give maximum net returns.

Rule 3. *When, in addition to the major enterprise, there are two or more enterprises which possess potential complementary features, choose those possessing these features if their inclusion in the farm business will pay for the extra*

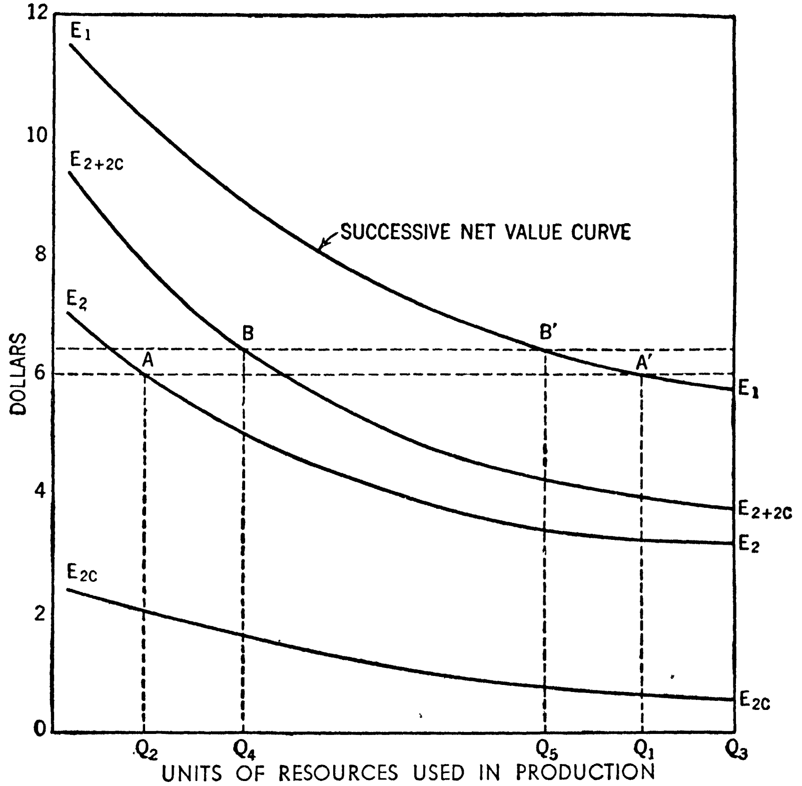


Fig. 12. How the farm resources will be used when one of a number of partially supplementary enterprises has potential complementary features.

cost and compensate for the extra managerial effort and risks involved.

Rule 3 is illustrated in Figure 12. If E_1 and E_2 alone are considered, then the resources should be distributed as in Figure 11. In this case OQ_1 resources are used in developing E_1, and OQ_2 in developing E_2. If, however, E_{2c}, a complementary enterprise to E_2, be considered, then the curve E_2 plus 2_c may be drawn, which is the sum of curves E_2 and E_{2c}. In this case then OQ_4 resources will be used in developing E_2 plus 2_c, and OQ^5 units of resources will be used in developing E_1. For it is when this distribution of resources is employed that the marginal returns for each enterprise are equal and the maximum net returns obtained.

Questions

1. Is gross value per acre a satisfactory basis for selecting farm enterprises? Qualify your answer.
2. State the advantages and disadvantages of using net returns as a basis for selection.
3. Discuss net returns per unit of man labor as a basis for selection of the enterprises.
4. State and explain the rules for combining enterprises.

References

Black, J. D., *Production Economics.* New York: Holt, 1926, Chapter IX.

Gray, L. C., *Introduction to Agricultural Economics.* New York: Macmillan, 1924, Chapters IX and X.

Holmes, C. L., *Economics of Farm Organization and Management.* Boston: Heath, 1928, Chapter XII.

Hopkins, John A., *Elements of Farm Management.* New York: Prentice-Hall, 1938, Chapters VII and VIII.

Taylor, H. C., *Outlines of Agricultural Economics.* New York: Macmillan, 1931, Chapters XI and XII.

CHAPTER VI

Selection and Combination of Farm Enterprises—Method of Substitution

THE methods of selecting farm enterprises discussed in Chapter V, Section 1, are defective and limited. Net returns per acre may be employed when the enterprises are similar as to supplementary or complementary features or when they compete seriously for the resources of the farmer. Inasmuch as these conditions are seldom fulfilled, net returns are at best an unreliable basis of selection. For the same reason the net returns per man hour are also unreliable. Inasmuch as it is tacitly assumed that the land area can be changed at will, an assumption which is not based on facts, the net returns per acre multiplied by the number of acres one man can operate is likely to lead to faulty conclusions. Evidently, what is needed is a method that is free from these defects. Three alternative methods have been devised, and, although they are not wholly above criticism, they are useful. These methods are: (1) the method of substitution, (2) the method of direct comparison, and (3) the standard method. In this chapter consideration will be given to the method of substitution. In Chapters VII and VIII the method of direct comparison and the standard method, respectively, will be presented.

1. The Method of Substitution

Briefly, the method of substitution consists of completely or partially substituting for the existing enterprises a different combination of enterprises and of checking the effect of the changes made on the total net income of the farm. The method has the advantage of being simple, direct, and practical. In contrast to the methods discussed in Chapter V, it avoids the necessity of calculating detailed enterprise costs and net returns, a task which is exceedingly difficult and subject to inaccuracies. Furthermore, the method takes into account supplementary, complementary, or joint cost relationships which may exist among the enterprises included in the farm organization.

This method may be explained best by using a concrete illustration. The illustration used has been taken from a study entitled "The Farm Organization in Southwestern Minnesota," *Minnesota Bulletin No. 205,* by G. A. Pond and J. W. Tapp. It should be said that Pond and Tapp were the first students of farm management to use the method of substitution.

For the effective use of the method of substitution, certain fundamental information must be available: (a) the extent and condition of the available farm resources, (b) the normal basic material and labor requirements for the production of crops and livestock products, (c) the normal yields of the various crops and output of various classes of livestock. By resources are meant the available factors of production, such as land available for crop production, pasture, and woodland; the number and kind of livestock maintained for productive purposes; the number and kind of workstock; machinery and tools used in production; and the amount of labor, both family and hired, which is at the disposal of the farm operator. It is important that a careful appraisal be made of the condition and extent of these various factors, more particularly the conditions of the farm buildings, as to whether or not they are adequate to accommodate any proposed changes in the organization of the farm.

In order to determine whether or not a suggested plan can actually be carried out by the farmer or whether or not a particular enterprise will or will not fit into a suggested plan, it is necessary to have accurate information on basic requirements, such as the amount of labor, seed, and material requirements used in the production of the various crop and livestock products. It should be emphasized that these material requirements represent the amounts normally used in any one year. Similarly, the yields and prices must be normal or those which are most likely to be obtained. Table 5, for example, gives the normal labor requirements per acre for crops on typical farms in Southwestern Minnesota which were used in reorganizing the farm described here. Table 7 gives the material requirements for crops; and Table 8, the feed, material, and labor requirements for livestock. The yields and prices used throughout this discussion are shown in Table 6.

TABLE 5

Normal Labor Requirements per Acre of Crops[a]

Operation	*Man Hours*	*Horse Hours*
Seedbed preparation:		
Plowing	2.50	10.00
Disking	0.56	2.24
Harrowing	0.28	1.12
Corn:		
Plowing	2.50	10.00
Disking (1.5 times)	0.84	3.36
Harrowing (2.5 times)	0.68	2.72
Planting	0.81	1.62
Cultivating (3 times)	4.00	8.00
Husking	7.25	14.00
Corn fodder:		
Cutting	1.71	5.13
Shocking	4.00	...
Oats:		
Disking (2 times)	1.12	4.48
Harrowing (1.1 times)	0.28	1.12
Seeding	0.52	2.08
Cutting	0.82	3.28
Shocking	1.10	...
Threshing	3.00	5.00
Barley:		
Plowing	2.50	10.00
Harrowing (2 times)	0.56	2.24
Seeding	0.52	2.08
Cutting	0.82	3.28
Shocking	1.10	...
Threshing	3.00	5.00
Wild hay:		
Mowing	1.67	3.34
Raking	0.83	1.66
Hauling and stacking	4.00	5.56
Alfalfa:[b]		
Mowing (3 times)	2.78	5.56
Raking (3 times)	1.40	2.80
Hauling (3 times)	10.00	12.50
Clover and timothy:		
Mowing	1.25	2.50
Raking	0.50	1.00
Hauling	2.25	5.50

---

[a] Data in this chapter taken from *Minnesota Bulletin 205.*

[b] Three cuttings of different amounts.

TABLE 6

YIELDS AND PRICES USED FOR ALL COMBINATIONS

Product	*Price per Unit*	*Yield per Acre*
Corn for grain (bu.)	.50	45
Corn fodder (tons)	..	2
Oats (bu.)	.30	42
Barley (bu.)	.40	25
Rye (bu.)	.70	18
Alfalfa (tons)	..	3.5
Clover and timothy (tons)	10.00	1.5
Wild hay (tons)	..	1.0
Butterfat (lb.)	.45	..
Pork (lb.)	.08	..
Beef (lb.)	.05	..
Wool (lb.)	.30	..
Mutton (lb.)	.10	..

TABLE 7

MATERIAL REQUIREMENTS FOR CROPS

Crop	*Seed per Acre*	*Twine per Acre*	*Threshing or Husking per Bushel*
Corn for grain	10.0 lb.	5.5 lb.	$0.06
Oats	3.2 bu.	3.4 lb.	0.03
Barley	2.3 bu.	3.4 lb.	0.03
Alfalfa	12.0 lb.	...	...
Clover	8.0 lb.	...	...
Timothy	6.0 lb.	. .	...

2. The Present Organization of the Farm

On the farm selected to illustrate the use of this method, there were 184.5 acres of land, of which 134.5 acres were in crops, 43 acres in pasture, and 7 acres in farmstead. These data are given in Table 9, together with the yield, the total production, and the disposition of the crops—that is, whether sold or fed. Reference will be made to this table in the course of the following discussion.

The buildings were sufficient to house all of the work-stock consisting of 6 head of horses, 12 cows, 24 miscellaneous cattle, 12 sheep, and 18 brood sows together with the pigs raised. (See Table 10.) The farm was also fully

TABLE 8

FEED, MATERIAL, AND LABOR REQUIREMENTS FOR LIVESTOCK

Item	*Horses (per horse)*	*Cows (per cow)*	*Misc. Cattle 0–1 Yr. Old (per head)*	*Misc. Cattle 1–2 Yr. Old (per head)*	*Pork (per cwt.)*	*Sheep (per head)*
Feed:						
Corn (lb.)	1,680	800	150	500	400	....
Oats (lb.)	1,600	1,200	400	400	90	40
Skim milk (lb.)	....	....	1,400	....	125	....
Whole milk (lb.)	...	....	180	....	....	....
Tame hay (lb.)	5,000	500	750	1,200	....	40
Alfalfa (lb.)	....	2,500	250	500	....	40
Corn fodder (lb.)	....	1,000	200	1,200	....	250
Wild hay (lb.)	600	....	....	....	....	....
Veterinary services and medicine (dollars)	1.00	0.80	0.60	0.60	0.20	...
Labor:						
Man hours	60.0	130.0	12.0	12.0	3.0	3.0
Horse hours	....	5.0	1.0	1.0	0.2	0.5

equipped with machinery and tools for production of small grain, hay, and corn—the type of crops produced. The man labor was supplied by the operator, a man hired from March to August, inclusive, and the operator's wife.

TABLE 9

CROP DATA RELATING TO ORIGINAL FARM

Crop	*Acres*	*Yield per Acre*[a]	*Total Production*	*Amount Required for Feed*[b]	*Salable Surplus*	*Amount Purchased*
Corn for grain (bu.)	39.0	45.0	1,755	1,955	...	200
Corn fodder (tons)	9.0	2.0	18	18	...	....
Oats (bu.)	50.0	42.0	2,100	1,190	910	....
Barley (bu.)	12.0	25.0	300	300	....	....
Rye (bu.)	6.0	18.0	108	....	108	....
Alfalfa (tons)	5.7	3.5	20	20	...	....
Clover and timothy (tons)	12.0	1.5	18	31	....	13
Wild hay (tons)	1.8	1.0	1.8	1.8	...	....
Total	134.5					

---

[a] See Table 6.
[b] See Tables 8 and 10.

TABLE 10

NUMBER AND PRODUCTION OF LIVESTOCK ON ORIGINAL FARM

Kind	*Number*	*Production*[a]
Cows	12	2,400 lb. butterfat
Young dairy and misc. cattle	24	8,000 lb. beef
Brood sows	18	20,000 lb. pork
Sheep	12	100 lb. wool 650 lb. mutton
Horses	6	

---

[a] See Financial Statement, Original Farm.

Since the net return for the farm as a whole is the measure of success used, it is necessary to know in any given case the financial returns for the original combination of enterprises. The direct sales of crops minus the direct expenses is usually sufficient, *because the fixed or overhead expenses are not in any way disturbed by the changes in the crops and livestock.* The assumption is that such substitutions as are suggested will not increase the fixed expenses of operation but will affect only direct costs. Hence, the amount of receipts from the sale of crops and livestock products together with a knowledge of the direct costs is sufficient for the purpose of determining the adequacy of any suggested combination of enterprises.

For this farm, as shown in detail on page 87, the sales from crops, oats and rye only, were $338. The cash income from the sale of livestock products was much greater, aggregating $3,175. The total cash income including the sale of crops and livestock products was $3,513. The deductions for materials, services, medicines, and feed were $613. The net cash income or difference between the total cash income of $3,513 and the total cash outlay of $613 is $2,900.

Although this net income may be considered satisfactory, the important question is: Can the resources available to this farmer be utilized more effectively by changing the combination of the farm enterprises? Or what changes in the combination of the farm enterprises are necessary in order to augment the net income?

Financial Statement, Original Farm

Sales:				
Crops:				
Oats	910 bu. @ 30¢		$273	
Rye	108 bu. @ 60¢		65	
Crop sales				$ 338
Livestock products:				
Pork	20,000 lb. @ 8¢		$1,600	
Beef	8,000 lb. @ 5¢		400	
Butterfat	2,400 lb. @ 45¢		1,080	
Wool	100 lb. @ 30¢		30	
Mutton	650 lb. @ 10¢		65	
Livestock product sales				3,175
Total sales				$3,513
Deductions:				
Materials, services, and medicine (See Table 11)			$383	
Feed:				
Corn	200 bu. @ 50¢	$100		
Hay	13 tons @ $10	130		
Total feed			230	
Total deductions				613
Total net returns				$2,900

TABLE 11

Direct Materials Expenses of Original Enterprises[a]

Enterprise	*Seed*	*Twine*	*Threshing or Husking*	*Veterinary and Medicine*	*Total*
Crops:					
Corn	$13	$6	$105	....	$124
Oats	48	20	63	....	131
Barley	11	5	9	....	25
Rye	6	1	6	....	13
Clover and timothy	13	....	....	....	13
Alfalfa	6	....	....	....	6
Livestock:					
Swine	....	....	....	$40	40
Cows	....	....	....	10	10
Misc. cattle	....	....	....	15	15
Horses	....	. .	....	6	6
Total	$97	$32	$183	$71	$383

---

[a] See Tables 7 and 8.

3. Suggested Changes

With this information relative to the organization of the farm and the net cash income, it is possible to make an analysis of the combination of enterprises used by the farmer and to determine its weaknesses. In this case, when the analysis was made, it was found that the operator had not developed a definite rotation of crops. A study of the organization also showed that the small grain production was overemphasized and corn was underemphasized, causing a feed shortage. The production of pork was low relative to the amount of skim milk available for use.

Certain suggestions naturally flow from this analysis. There was evidence that a reduction in small-grain acreage and an increase in corn acreage would make for a balanced rotation and, at the same time, provide for a sufficient amount of feed. With the same labor resources the corn and hay acreage could be increased. More pork could be produced by raising fall litters, but in this case it would be necessary, perhaps, to purchase more corn. On the whole, decreasing small-grain acreage and increasing corn and hay appeared advisable. To show what might be accomplished, two plans were offered.

Plan Number 1

In Plan Number 1 the changes involve the elimination of barley and rye, a reduction of oat acreage, and an increase in the acreage of corn and hay. Table 12 shows the revised cropping plan, together with the distribution of feed. The chief changes made in the cropping system are: an increase in the corn for grain from 1,755 bushels in the original to 2,520, or an increase of 765 bushels; the elimination of barley and rye; the reduction of the oat crop from 2,100 to 1,764 bushels, or a decrease of 336 bushels; and an increase of clover and timothy hay from 18 to 30 tons, or an increase of 12 tons. (Compare Tables 9 and 12.)

TABLE 12

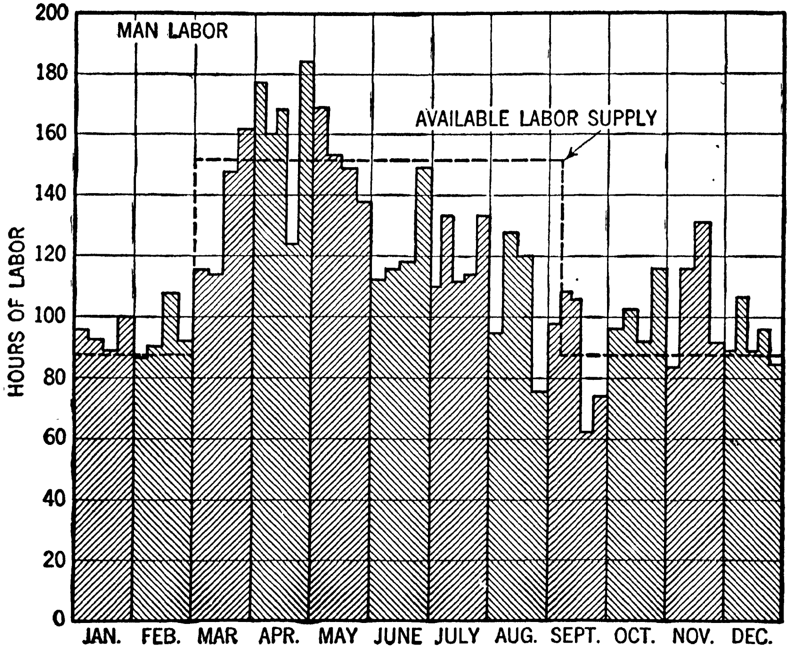
Crop Data for Reorganization Plan Number 1

Crop	*Acres*	*Yield per Acre*	*Total Production*	*Amount Required for Feed*	*Salable Surplus*	*Amount Purchased*
Corn for grain (bu.)	56	45	2,520	1,954	566	....
Corn fodder (tons)	9	2	18	18	....	....
Oats (bu.)	42	42	1,764	1,640	124	....
Alfalfa (tons)	5.7	3.5	20	20	....	....
Clover and timothy (tons)	20	1.5	30	31	....	1
Wild hay (tons)	1.8	1.0	1.8	1.8	....	...

The suggested corn production is sufficient for feed requirements, with 566 bushels for sale. However, a small amount of hay must, according to this plan, be purchased. The livestock is not altered in any way; neither are the overhead expenses changed. The difference in the probable net income, therefore, is due solely to the change in crop sales, to the feed purchased, and to the materials cost for the crop enterprises. The crop sales decrease only $19, but the decline in the feed bill is $220, and the decline in direct material expense is $1 (compare financial statements). There is a gain of $202 in favor of the new plan. The financial statement is as follows:

Sales:			
Crops:			
Corn	565 bu. @ 50¢	$283	
Oats	120 bu. @ 30¢	36	
Total crop sales			$ 319
Livestock products (same as original)			3,175
Total sales			$3,494
Deductions:			
Materials for crops (See Table 13)		$311	
Veterinary and medicine (Table 11)		71	
Feed, 1 ton hay @ $10		10	
Total deductions			392
Total net returns			$3,102
Original plan			2,900
Gains for Plan Number 1			$ 202

The suggested plan has several advantages over the old one. In the first place, the new plan increases the net returns $202, which at 5 per cent means an increase in the value of the farm as a business unit of about $4,000. The plan also provides for a margin of safety between the amount produced and the normal feed requirements. These changes are made without increasing the cost of labor. (See Figures 13, original organization, and 14, suggested reorganization.) Under the new plan 4,500 hours of regular labor for crops and livestock and 900 hours on miscellaneous crops, livestock, and maintenance labor are required. It may be seen from Figure 14 that the only time when the labor requirements exceed the supply is in the corn-husking time in the late fall. Most husking labor is hired anyway



Courtesy of Minnesota Agr. Exp. Sta.

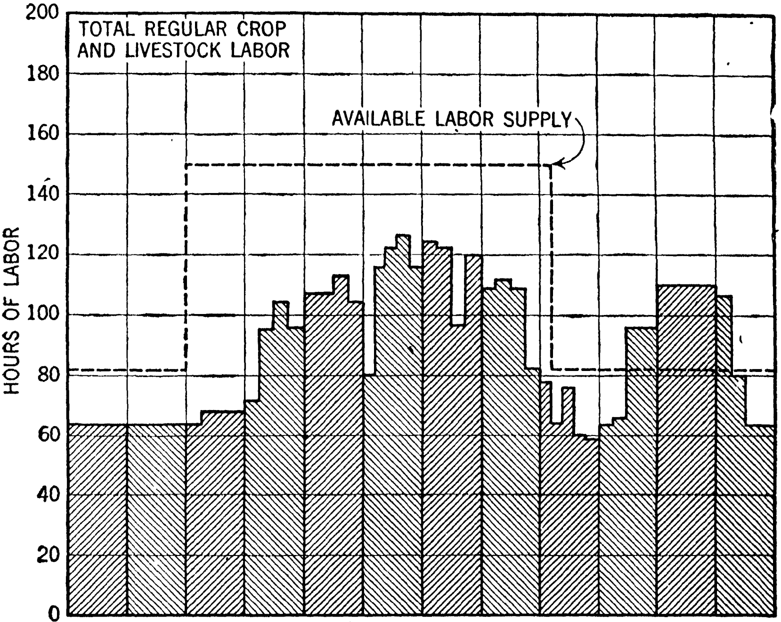
Fig. 13. The monthly distribution of man labor on a southwestern Minnesota farm.

and is taken care of in the materials expense for corn. (See Table 13.)

TABLE 13

Direct Materials Expenses for Reorganized Plan Number 1

Crop	*Seed*	*Twine*	*Threshing or Husking*	*Total*
Corn	$17	$6	$151	$174
Oats	40	17	53	110
Clover and timothy	21	....	....	21
Alfalfa	6	....	....	6
Total	$84	$23	$204	$311



Courtesy of Minnesota Agr. Exp. Sta.

Fig. 14. The monthly distribution of man labor on a southwestern Minnesota farm after a suggested reorganization of the farm enterprises.

Plan Number 2

Plan Number 1, although satisfactory, does not fully utilize the available resources, especially the labor supply. (Note Figure 14.) There is ample opportunity for expanding production without increasing the labor cost. The history of this farm shows that in one year 30 additional acres were rented and that the operator handled these additional acres without seriously reducing the crop yields. As one of the weaknesses of the original farm is the low production of pork in proportion to skim milk available, it is obvious that an increase in this enterprise might increase the total net returns. In Plan Number 2 it is suggested that pork production be increased by having the sows farrow in the fall and on a scale sufficient to produce 30,000 pounds of pork. In order to accomplish this, the corn and oat acreage must be increased.

These suggestions could not be carried out on this farm unless additional land were acquired. As the 30 acres formerly rented were still available, it was suggested that they be leased and used for the production of grain, thus providing the necessary feed for the suggested expansion in the hog enterprise. The 30 additional acres acquired are to be used specifically as follows: corn, 14 acres; oats, 8 acres; clover and hay, 5 acres; pasture, 2 acres; and corn and fodder, 1 acre. The total suggested distribution of crop acres, yield, production, amount fed, and salable products is shown in Table 14.

TABLE 14

CROP DATA FOR REORGANIZATION PLAN NUMBER 2

Crop	*Acres*	*Yield per Acre*	*Total Production*	*Amount for Feed*	*Amount for Rent*	*Salable Surplus*
Corn for grain (bu.)	70	45	3,150	2,650	325	175
Corn fodder (tons)	10	2	20	All	. .	....
Oats (bu.)	50	42	2,100	1,900	200	....
Clover and timothy (tons)	25	1.5	37.5	All	....	....
Wild hay (tons)	1.8	1.0	1.8	All	....	....
Alfalfa (tons)	5.7	3.5	20	All	....	...

The present buildings and machinery are adequate to take care of the increase in the hog enterprise, and the labor supply is sufficient to operate the added acreage. The rent for the additional land is paid for in corn and oats (Table 14). However, the suggested increase in the pork production causes an increase in the veterinary and medicinal expenses, and an increase in the crop production adds some to the crop expenses. (See Table 15.)

TABLE 15

Direct Materials Expenses for Reorganized Plan Number 2

Enterprise	*Seed*	*Twine*	*Threshing or Husking*	*Veterinary and Medicine*	*Total*
Corn	$ 22	$ 7	$189	....	$218
Oats	48	20	63	....	131
Clover and timothy	27	....	....	....	27
Alfalfa	6	....	....	...	6
Hogs	....	...	....	$60	60
Cows	....	....	....	10	10
Misc. cattle	...	....	....	15	15
Horses	....	....	....	6	6
Total	$103	$27	$252	$91	$473

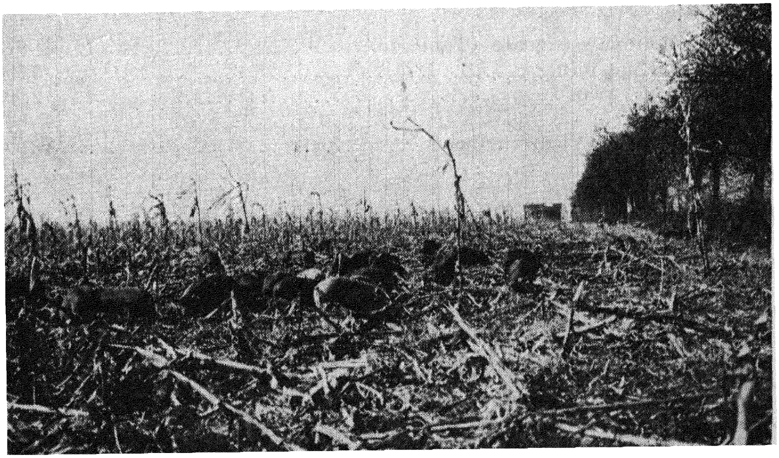


Illustration from Bu. of Agr. Econ.

Fig. 15. The addition of livestock to the farm organization may increase the net returns to the farm as a whole.

The probable financial returns for Plan Number 2 are summarized below, and show the crop sales to be $88 and livestock and livestock products sales to be $3,975, making a total cash income of $4,063. On the expense side the direct materials cost is $473, leaving a net cash return of $3,590. As the original plan returned $2,900, the gain for the new plan is $690. It should be noted also that Plan Number 2 is a gain over Plan Number 1 of $488.

Financial Returns, Reorganized Plan Number 2

Sales:			
Crops:			
Corn	175 bu. @ 50¢		$ 88
Livestock:			
Pork	30,000 lb. @ 8¢	$2,400	
Beef	8,000 lb. @ 5¢	400	
Butterfat	2,400 lb. @ 45¢	1,080	
Wool	100 lb. @ 30¢	30	
Mutton	650 lb. @ 10¢	65	
Total livestock			3,975
Total sales			$4,063
Deductions:			
Direct materials expense (Table 15)			$ 473
Total net returns			3,590
Original plan			2,900
Gains for Plan Number 2			$ 690

Returns, Plan 2	$3,590
Returns, Plan 1	3,102
Gain over Plan 1	$ 488

Plan Number 2 has certain advantages over both the original plan and Plan Number 1. First, it calls for no additional resources except 30 acres of land, which may be leased, and some additional hired labor; yet it brings a net return of $690 over the original plan. This increase in net returns is traceable to a better utilization of the labor supply as well as of the land and buildings. It also provides for a margin of safety in the case of feed crops. Thus, in periods of low yields the farmer probably will need to buy little, if any, feed for his livestock. This plan, however, calls for more careful planning of the operations than does the original organization and will make additional demands upon the time of the farmer. Such an expansion as suggested in Plan Number 2 is justified only if the farmer's managerial ability is not being used to its full capacity.

The method of substitution, as illustrated above, may be used effectively in increasing the farmer's income. It goes to the heart of the problem and avoids some of the embarrassing questions that arise in determining enterprise costs. A careful study of the facts collected permits the combining of the enterprise in the proportion that will utilize to the best advantage all available resources and gives also consideration to the supplementary and complementary features which any or all of the enterprises may possess.

4. The Theory of Equi-marginal Returns and the Method of Substitution

The question may be raised whether the use of this method ignores the principle of equi-marginal returns as discussed in Chapter V, Section 3. The application of this principle in the solution of actual problems is a difficult task, for the simple reason that the data needed are usually not available. It can be said, however, that the principle has been used indirectly. The student will recall that the concept of equi-marginal returns embodies the idea of maximum net returns to the farm as a whole. That is, if the resources of the farm have been properly allocated, then the net income is at a maximum. To the extent, then, that the use of the method of substitution results in an increase in income, it can be assumed that the resources have been more effectively allocated. If it could be said that the net income of the farm, in any given case, was maximized, then it would follow that the conditions of the principle of equi-marginal returns were fulfilled. But this cannot be claimed for the method. All that can be said, then, is that in reallocation of the farm resources, if the net income has been increased, it indicates that the conditions, required by the principle of equi-marginal returns, have been approached or partially fulfilled.[1]

Questions

1. How is the method of substitution used to determine whether or not a given enterprise should be included in the farm program?

2. Describe the procedure followed in this method.

3. Appraise this method as to its practicability and simplicity in actual use.

References

Pond, George A., and Tapp, Jesse W., "A Study of Farm Organization in Southwestern Minnesota," *Minnesota Bulletin 205.* 1923.
Social Science Research Council, "Research in Farm Management," by John D. Black (Editor), Project No. 8, New York.
U. S. Department of Agriculture, *Department Bulletin 1196.* "A Study of Farm Organization in Central Kansas," by W. E. Grimes, J. A. Hodges, R. D. Nichols, and Jesse W. Tapp. 1925.

---

[1] See also Chapters VIII and X.

CHAPTER VII

Selection and Combination of Farm Enterprises—Method of Direct Comparison

SOME authorities object to the method of substitution discussed in Chapter VI. They prefer to use instead what is called the method of direct comparison when suggesting improvements in the organization and operation of a farm. According to this method, suggestions relative to the organization or management of a given farm are based solely upon the experiences of a large number of farmers who are following the same type of farming as the farmer whose farm is the object of study. These authorities believe that adjustments based upon the experiences of successful farmers are more trustworthy than those made according to the method of substitution. To state this more specifically, the farmer who makes changes in his farming practices, the combination of his farm enterprises, the size of his farm, the yields of his crops, or any other factor, is more likely to meet with success if such changes are based upon experiences of successful farmers than he would if they are made according to the method of substitution. The fundamental theory upon which this conclusion is based is that farming practices followed by successful farmers have been subjected to all of the forces both economic and physical that are at work in a given area and are, therefore, more reliable than practices which may be derived from experimental data or which are purely the figment of the imagination.

It is only fair to point out that this criticism of the method of substitution is only partly valid. The changes effected by the method of substitution are not made without reference to the experience of other farmers or without reference to the economic and physical forces that work in the area. As a matter of fact, the changes suggested are based upon the farm management data collected in the area. Furthermore, the changes are always in line with that which the farmer has been doing in the past. That is, it is seldom, if ever, recommended that a farmer do something entirely different from what he has been doing. On the contrary, it is recommended that he do a little more or less of the same things that he has been doing in the past. The suggested changes, however, are not based necessarily upon the records of successful farmers, unless it is thought that the farmer can in fact carry out such changes as might be suggested from a study of successful farmers. In short, the farmer's capacity and efficiency are always considered in making adjustments.

1. Basic Information Needed

The use of the method of comparison involves, as does the method of substitution, the collection and analysis of statistics on farm organization and management. The data used are somewhat the same in both cases, although the methods used in collecting and in analyzing that data are quite different. When the method of substitution is used, a relatively small number of farms, usually from 30 to 40, are studied intensively, while in the case of the method of comparison several hundred farms are studied in an extensive manner. Specifically, the information collected for the method of comparison may be classified as follows:

A. Resources:
    1. Land area.
    2. Farm buildings.
    3. Machinery and tools.
    4. Feed and supplies.
    5. Livestock.
    6. Labor available.

B. Receipts:
    1. The sale of crops.
    2. The sale of livestock and livestock products.
    3. The value of farm products used in the home.

    4. Income from outside sources, such as the wages received for work off the farm.
    5. Increases in inventory.
- C. Expenses:
    1. Current operating expenses, such as hired labor, purchase of seed, fertilizer, feed, and so forth.
    2. Livestock, machinery, and tools purchased.
    3. Insurance.
    4. Depreciation of machinery and buildings.
    5. Decreases in inventories.
- D. Crop record. For each crop produced there is obtained:
    1. Acreage.
    2. Yield.
    3. Production.
    4. Disposition—that is, sold, fed to livestock, or used in the farmhouse.
- E. Livestock record. For each class of livestock there is obtained:
    1. Number and value at the beginning of the year.
    2. The sales.
    3. Purchases.
    4. Number of livestock died during the year and value.
- F. Miscellaneous information:
    1. The location of the farm and distance from market.
    2. Name, age, and address of the operator.
    3. Soil type of farm and topography.
    4. Distribution of farm acreage, that is, area in crops, pasture, woods, and so forth.
    5. Breed of livestock raised.
    6. Description of farm family—number, age, and education.
    7. The agricultural experience of the farmer—the number of years a tenant, a part owner, and a full owner.
    8. Other miscellaneous information, such as the mortgage on the farm, price paid for the farm, kind of accounts kept, if any, and so forth.

2. The Method Used in Collecting Necessary Information

There are two common methods used in collecting the required information—namely, the farm management survey method and the farm account book method. When the survey method is used, the information is recorded on a uniform schedule (see *Farmers' Bulletin 1139,* U.S.D.A.) by trained enumerators. These enumerators, or field men, as they are usually called, obtain the data by personal interviews with farmers. The information is carefully checked for possible omissions and inaccuracies. After the corrections have been made and omissions, if any, have been supplied, the data are transferred to an office sheet. The office sheet is, in the main, a duplicate of the field sheet used by the enumerator, but in addition it provides for a summary of the farm business and for specific "efficiency" factors affecting the earnings. It is from data on the office sheet that the analyses are made.

When farm account books are used, the farmer is required to keep a careful record of his farm operations throughout the year. These books are usually audited or examined frequently in order to make sure that the information is being collected in the proper form. At the end of the year the books are collected, and the data are summarized and analyzed much in the same manner as is done in the case of the farm survey method.

3. Method of Analysis

The method of analysis follows a distinct pattern of four steps or phases. First, there is a detailed summary of the year's business, which gives the investment, receipts, expenses, and some measures of general success, such as the net farm income, the labor income, or the labor earnings.[1] The second phase usually consists of an extensive statement of the factors affecting or associated with success. Among such factors may be listed crop yields, per cent of land in high profit crops, and size of the business, as measured by acres in the farm or the total number of work units. The third phase, closely associated with the second and often a part of it, is the presentation of what are called "efficiency" factors. These factors are actually input-output ratios, such as the gross returns (output) from livestock per $100 of feed fed (input). The final phase in the analysis consists of showing how various combinations of "factors" affect returns. Each of these phases will be discussed and their use and significance indicated.

---

[1] See Chapter XI for definitions.

a. Summary of the year's business. Table 16 illustrates the first phase of the analysis, which consists of a summary of the year's business. There are three groups of items—investment, farm expenses, and farm receipts—and the operator's labor earnings, which are used as the measure of success. These items are usually presented in much more detail than in Table 16, which has been condensed. For example, farm expenses may consist of twenty items or more. It is not always true that the summary of the year's business will be presented in a simple table. There may be a table for investment or inventories, another for expenses and receipts.

The mode of presentation of this information is significant. The items are listed on the "stub" or on the left side of the table, and to the right are four columns. The first column, labeled "your farm," is reserved for the individual farmer's data. The second column is the average for all farms for each item shown on the stub. The third and fourth columns show the averages for the most profitable and least profitable farms. The reason for this arrangement is obvious. The individual farmer, receiving this report, can compare, item for item, his data with the average of all farms—the least profitable and the most profitable. Such a comparison not only places the farmer in one of the three groups, but also indicates the "weaknesses" and "strong points" of his farm business. For example, the average investment for the 33 most profitable farms, as shown in Table 16, is $57,133, whereas for the 33 least profitable farms it is $27,708. If for a given farm the labor earning is low, the reason may be his low investment, or, if his investment is equal to that of the most profitable farms, it may be that his expenses have been excessive. Thus, by comparing his business, item by item, with the data in columns 2, 3, and 4, any given farmer may discover the reasons for his position with respect to returns, or at least this is the tacit assumption of the method of direct comparison.

b. Factors affecting returns. The second phase of the analysis consists in showing how certain selected "factors"

TABLE 16

SUMMARY OF THE YEAR'S BUSINESS[a]

	1	*2*	*3*	*4*
Items	*Your Farm*	*Average of 166 Farms*	*33 Most Profitable Farms*	*33 Least Profitable Farms*
Investment Beginning of the Year				
Horses	$———	$ 369	$ 445	$ 340
Productive livestock (total)[b]	———	4,567	9,558	2,739
Crop, seed, and feed[b]	———	4,126	6,692	3,096
Machinery and equipment (total)	———	2,943	4,517	2,145
Buildings, fences, etc.	———	7,487	10,580	6,599
Land	———	15,812	25,341	12,789
Total investment	$———	$35,304	$57,133	$27,708
Farm Expenses[b]				
1. Total farm purchases	$———	$ 8,355	$18,320	$4,647
2. Decrease in farm capital	———	———	———	———
3. Board furnished hired labor	———	171	298	127
4. Interest on farm capital	———	1,831	3,008	1,403
5. Unpaid family labor	———	288	431	231
6. Total farm expenses (Sum of (1) to (5))	$———	$10,645	$22,057	$6,408
Farm Receipts[b]				
1. Total farm sales	$———	$11,704	$23,804	$6,632
2. Increase in farm capital	———	2,618	6,039	712
3. Family living from farm	———	538	702	445
4. Total farm receipts (1+2+3)	$———	$14,860	$30,545	$7,789
5. Total farm expenses	$———	$10,645	$22,057	$6,408
Operator's Labor Earnings (Receipts minus expenses)	$———	$ 4,215	$ 8,488	$1,381

---

[a] Adapted from the *Annual Report* of Southwestern Minnesota Farm Management Service. Mimeograph report No. 129. Prepared by T. R. Nodland, G. E. Toben, and G. A. Pond.

[b] A number of sub-items have been omitted.

affect or may affect returns. The method of procedure is shown in Table 17. The tabular scheme is the same as described under 3a. On the stub are listed the "factors," and to the right are the four columns, one reserved for the farmer and the other three reserved for the averages of all farms, most profitable, and least profitable farms. The operator's labor earnings are also shown. In this case seven factors are listed: (1) crop yields, (2) per cent tillable land in high return crops, (3) returns for $100 feed fed to productive livestock, (4) productive livestock units per 100 acres, (5) size of the business as measured by work units, (6) work units per worker, and (7) investment expense, other than land, per work unit. For each of these "factors," the 33 most profitable farms made the "best" showing. For example, crop yields were 11 per cent higher on these farms than for the average of all farms, and 26 per cent above the average of the least profitable farms. The investment per work unit is less for the most profitable farms, and the operator's labor income is 101 per cent greater than the

TABLE 17

MEASURES OF FARM ORGANIZATION AND MANAGEMENT EFFICIENCY

Measures	*Your Farm*	*Average of 166 Farms*	*33 Most Profitable Farms*	*33 Least Profitable Farms*
Operator's Labor Earnings	$———	$4,215	$8,488	$1,381
1. Crop yields	———	100	111	88
2. Per cent of tillable land in high return crops	———	36.5	37.1	34.8
3. Returns for $100 feed to productive livestock ...	———	100	105	90
4. Productive livestock units per 100 acres	———	24.7	33.3	19.7
5. Size of business—work units	———	631	957	458
6. Work units per worker...	———	264	293	227
7. Investment expenses per work unit	$———	$2.30	$2.23	$2.66

average for all farms and 514 per cent above the least profitable farms. It is assumed that the individual farmer can compare the result on his farms, as shown in Column 1, with the data in Columns 2, 3, and 4, and thus discover any defects in the way he is operating his farm. Or, if his farm is above the average in any or all of these seven factors, to that extent is his farm being operated successfully.

c. **Efficiency factors or input-output relations.** The second phase of the analysis, as described in 3b, is often expanded into an elementary study of input-output relations. This extension of the analysis is illustrated by the data in Table 18. The general scheme of presenting the data is the same, but the emphasis is placed on the returns (output) per unit of input. In this case, the returns from feeding several classes of livestock are expressed in terms of $100 of feed fed. For example, in the case of dairy cattle, for each $100 of feed consumed, the returns for all dairy cattle on the 166 farms is indicated by the index 100, for the most profitable farms the index is 103, or 3 per cent higher than the average for all farms. But for the least profitable farms the index is 91, or 9 per cent less than the average of all farms and 12 per cent less than the most profitable farms. When the farmer's feeding index is given in Column 1, it is possible for him to compare his results with the three groups as given in Columns 2, 3, and 4. In this manner, it is assumed that he can determine any weakness in his feeding practices. For example, suppose that his index of feeding dairy cattle was only 70. This would indicate, as compared with the other groups, a decided defect which if corrected might lead to higher operator's labor earnings.

d. **Combination of factors and returns.** Returns on any given farm, according to the method of direct comparison, will be affected by the combination of the seven factors listed in Table 17. If a farmer has been able to obtain yields that are above the average, or has a higher

TABLE 18

INDEX OF RETURNS PER $100 FEED FED TO DIFFERENT CLASSES OF LIVESTOCK [a]

Item	1 Your Farm	2 Average of 166 Farms	3 33 Most Profitable Farms	4 33 Least Profitable Farms
Dairy cattle	———	100	103	91
Dual-purpose cattle	———	100	97	99
Beef cattle—breeding herd	———	100	114	94
Beef cattle—feeders	———	100	105	81
Hogs	———	100	104	93
Sheep—farm flock	———	100	103	75
Sheep—feeders	———	100	109	76
Turkeys	———	100	98	124
Chickens	———	100	90	97

[a] Adapted from *Annual Report* of the Southwestern Minnesota Farm Management Service, 1941, Mimeographed Report Number 129, p. 12.

than average per cent of his crop in "high return" crops, or more than average work units per worker, his returns will be higher than a farmer who has been unable to attain such a high rating. That this may be true is indicated when the farms are classified according to their attainment or proficiency. In Table 19, the 166 farms have been classified as to the number of "factors" in which each farm excelled. As the number of factors in which the farms excelled increased, the operator's labor earnings increased. Those farms which did not excel in any factor had an average operator's labor earnings of $1,696, whereas those which excelled in one factor had an average operator's labor earnings of $2,657. Farms that excelled in all seven factors had an average operator's earnings of $9,251, or each factor added affected operator's earnings about $1,079.

To emphasize the importance of these seven factors, the effect of each on the operator's labor earnings or labor income is studied independently. An excellent illustration of this type of analysis is shown in Tables 20 to 26, inclusive.

TABLE 19

RELATION OF OPERATOR'S LABOR EARNINGS TO THE NUMBER OF FACTORS IN WHICH THE FARMER IS ABOVE AVERAGE

No. of Factors in Which Farm Excels	*No. of Farms*	*Your Farm*	*The Lengths of the Shaded Lines Are in Proportion to the Average Operator's Labor Earnings*	*Average Operator's Labor Earnings*
None	4	______		$1,696
One	20	______		2,657
Two	24	______		3,353
Three	44	______		3,297
Four	33	______		4,991
Five	27	______		5,230
Six	11	______		7,321
Seven	3	______		9,251

The comment on these tables, as given by Nodland, Toben, and Pond, is as follows:[2]

> The operator's labor earnings varied widely among the farmers included in this study.[3] The average labor earnings of those farmers ranking in the upper 20 per cent in the range according to earnings was $8,488 and of those in the lower 20 per cent was $1,381. [See Table 17.] This is a range of $7,107 between the average earnings of these two groups. Some of the causes for these differences in earnings may be beyond the control of the farmer. However, all of these farmers could make some changes in their farming operations that would increase earnings. A farmer can secure some ideas as to changes that could profitably be made on his farm by studying the facts about his business and comparing his accomplishments with other farmers following the same general type of farming. The more important management factors affecting earnings and their relationships with earnings are presented in the following tables.
>
> High production per acre, up to certain limits, tends to lower the cost per bushel of grain or per ton of hay. [Compare with discussion in Chapter V.] Any possible method of management that will increase crop yields and therefore lower cost of production more than the extra expense incurred in securing the higher yields should be given consideration.

---

[2] *Annual Report* of the Southwestern Minnesota Farm Management Service, 1941, pp. 8–10.

[3] Crop-livestock type of farming in Southwestern Minnesota.

TABLE 20

Relation of Crop Yields to Farm Earnings

Per Cent Crop Yields Were of the Average for All 166 Farms		*No. of Farms*	*Average Operator's Labor Earnings*
Group	*Average*		
Below 86	71	38	$2,541
86–113	102	83	4,684
114 and above	123	45	4,763

TABLE 21

Relation of Choice of Crops to Farm Earnings

Per Cent of Tillable Land in High Return Crops		*No. of Farms*	*Average Operator's Labor Earnings*
Group	*Average*		
Below 31.0	27.0	36	$3,908
31.0–39.9	36.1	89	3,955
40.0 & above	45.9	41	5,048

Farmers' earnings are affected by the choice of crops as well as by the yields of crops. As a rule, on these farms, such crops as alfalfa, clover, canning crops, sugar beets, corn, and flax bring a higher net return per acre than other crops usually grown. [Compare with discussion in Chapter V.] Additions can be made to earnings by putting as high a percentage as possible of the tillable land into these higher return crops.

TABLE 22

Relation of Returns from Productive Livestock to Farm Earnings

Index of Returns for $100 Feed Fed to Productive Livestock [a]		*No. of Farms* [b]	*Average Operator's Labor Earnings*
Group	*Average*		
Below 84	74	30	$3,397
84–117	98	105	4,384
118 and above	131	30	4,446

[a] The index is weighted by the number of animal units.
[b] One farmer did not raise livestock.

The majority of these farms are livestock farms. A large proportion of the crops raised are fed on the farm and some additional feed is purchased. Feed is the major item of cost in livestock production, and livestock constitutes an important source of income on these farms. Hence, there is a marked relationship between returns for $100 of feed and operator's labor earnings on these farms. There are a number of reasons for differences among farms in livestock returns. High productivity per animal and economy in the use of feed and labor are important. Other factors of considerable importance are kind of feed used, quality of pastures, balance of ration, degree of sanitation, and kind of shelter and equipment.

TABLE 23

Relation of Amount of Productive Livestock to Farm Earnings

Productive Livestock Units per 100 Acres[a] *Group*	*Average*	*No. of Farms*	*Average Operator's Labor Earnings*
Below 16.0	11.6	45	$3,239
16.0–29.9	22.6	77	4,271
30.0 and above	42.6	43	5,158

[a] Acres in timber not pastured; roads, waste, and farmstead were not included.

On some farms the returns from livestock are so low that they do not cover feed and other costs. Such livestock is unprofitable, especially if there is more than enough to utilize what would otherwise be waste feed. *If the livestock is yielding a net return,* an increased amount of livestock adds to size of business and the opportunity to increase the farm earnings. Livestock produces manure and aids in keeping up the fertility of the land, and utilizes waste products on the farm. Livestock also helps to provide productive employment throughout the year. Any method that aids in utilizing the available resources to full and efficient capacity should add to the farm income.

TABLE 24

Relation of Size of Business (Work Units) to Farm Earnings

No. of Work Units *Group*	*Average*	*No. of Farms*	*Average Operator's Labor Earnings*
Below 400	339	31	$2,175
400–699	551	89	3,846
700 and above	982	46	6,304

The size of the farming operations is one of the important factors affecting the earnings of farmers. On the average, the farmers with a large business had larger earnings than the farmers with a small business. The size of the farm business is here measured in terms of the number of work units. For farmers operating their farms at a loss, the larger the volume of business, the larger will be the loss; but a farmer who is making a profit could make a larger profit if he increased his size of business, providing that in so doing he does not materially lower the efficiency in some one or more important branches of his business. Those farmers who have large businesses usually have more flexibility of their organization than does the man with a small business, and can utilize more efficiently and to better advantage available labor, power, machinery, and buildings. The size of the farm business may be increased by farming more land, by keeping more livestock, or by keeping livestock or growing crops of a more intensive type.

TABLE 25

Relation of Amount of Work Accomplished per Worker to Farm Earnings

Work Units per Worker		*No. of*	*Average Operator's*
Group	*Average*	*Farms*	*Labor Earnings*
Below 215	185	40	$3,195
215–299	254	82	4,122
300 and above	355	44	5,315

Farmers' earnings are generally higher on those farms on which a large amount of work is accomplished per worker. More days of productive work accomplished per worker reduces the labor charge per unit of business. Higher labor accomplishment can be secured in several ways. In the first place, the business must be large enough so that there will be at least sufficient work available for the family labor. The farm should be so organized that the labor requirements are well distributed throughout the year. Handling pastures in such a way that as large a proportion as possible of the year's feed for livestock may be obtained from them helps to reduce labor requirements. Proper planning of the farm work and economical use of labor-saving machinery help to increase the work accomplished per worker.

TABLE 26

Relation of Power, Machinery, Equipment, and Building Expense to Farm Earnings[a]

Expense per Work Unit		*No. of*	*Average Operator's*
Group	*Average*	*Farms*	*Labor Earnings*
$2.65 and above	$3.28	43	$3,830
$1.60–$2.64	2.13	96	4,340
Below $1.60	1.40	27	4,381

[a] Includes buildings, fencing, all crop machinery and livestock equipment, horse feed, and miscellaneous horse expense.

The expense factor does not show as high relationship with earnings when prices are high as when they are low. Some farms are underequipped. On a few farms, excessive expenses constitute the main factor causing earnings to be very low.

Some of the cash expenses can be kept down by careful management. Oftentimes necessary repairs and improvements can be made by using the available farm labor rather than by hiring extra help. Repairs and overhauling should be done before spring work begins in so far as possible, or on rainy days or in other spare time during the summer. Reducing the number of horses to the minimum required for efficient operation of the farm helps to reduce the power expense. In some cases, farmers can offset some or all of the power and machinery expense by using their equipment for outside work.

4. Criticisms of the Method

The method of direct comparison has been subjected to criticism by students of farm management. Unquestionably, the method has merit, for the alert farmer or the farm manager can use it advantageously. A comparison of the organization of a given farm with the best in the area will undoubtedly suggest changes that, if made, would lead to increases in the profits of the farm. However, there is no assurance in advance that such changes would lead to increases in the profits of a specific farm. For example, suppose that the size of a given farm is 100 acres and that the size of the most profitable farms averages 200 acres. This would not necessarily mean that the 100-acre farmer should attempt to increase his farm to 200 acres. In fact, to do so might result in decreased rather than in increased returns, unless the farmer had the capacity to operate a 200-acre farm.

The combination of one or more of the several "factors," as suggested in Table 19, is especially defective. This is quite obviously a case of functional relationship in which each factor affects or is associated with returns. It would be expected that any classification of farms on these factors would show some change in the net return or operator's labor income. This change, however, might be positive or negative, depending upon the particular combination of the factors. The transition from this fact to that of assuming that a given farmer can increase his net returns by increasing the number of "factors" is unwarranted. This statement can be substantiated by selecting any factor, such as yield per acre, and determining its functional relationship to returns. In order to determine whether or not returns are affected by yields it would be necessary to conduct an experiment in which yield was the only variable factor. (See Chapter V.) Since in this case this requirement has not been fulfilled, it is obvious that no valid conclusions can be drawn from yield data other than to say that farms with higher yields have on the average higher operator's labor income. But all this means is that each farm, as far as yields are concerned, is being operated at a given *level* of intensity; and, since each farm is operated at a different level of intensity, which for its conditions may be correct, it is assumed, incorrectly, that an increase in returns may be obtained by increasing the yields.[4]

The method of direct comparison may be criticized also for the statistical techniques used. In most cases the construction of the frequency tables is faulty. The classes are usually too few in number and the class intervals[5] are not, as a rule, uniform. For example, in Tables 20 to 26 there are only three classes or groups and the class interval is different for each group. When the class intervals are either indeterminate—*i.e.*, open—or vary from one group to another, the resulting data (in this case average operator's earnings) may not be trustworthy. The reason for this is that the mean or average for each class can never be greater than the upper limit or less than the lower limit of the class. This relationship between the class limits and the mean of the class requires that the class intervals be equal if reliable results are to be obtained. The investigator may, through a "juggling" of the class intervals, get results that are quite different, indeed may be directly opposite, to those obtained when uniform class intervals are used.

There is no fixed rule governing the number of groups or classes used in tabulating data. The number will depend upon the nature of the data. In general, it may be said that the number of classes should be used that gives the most accurate description of the data and permits valid interpretations. In no case should classes be combined so as to give results that are either ambiguous or contrary to fact.

---

[4] See *Journal of Farm Economics,* Vol. XXVI, No. 4, p. 775.

[5] The distance between the lower and upper limit of the class.

The second criticism of the statistical techniques used is based on the absence of homogeneity of the classes. This is evident in Table 19 when certain "factors" are used for the basis of classification of the farms and for the calculation of the means. Some of these factors refer to intensity, such as crop yields, whereas others obviously refer to the scale of production. Furthermore, the combination of "factors" in any one class is not necessarily identical. For example, in the third group the basis of classification is two factors, but these are not always the same two but a combination of any two of the seven factors used. When homogeneity is lacking, the data resulting from classification are not comparable. Nor is the direction of the data significant. In this case the operator's labor earnings increase as the number of "factors" combined increases, but this may be the result of the concentration of some factor or factors in the groups. For example, the second group may be largely factors measuring intensity rather than scale. Whereas other groups, say the seventh, includes both intensity and scale factors.

Questions

1. What is meant by the method of "direct comparison"?
2. How are the data collected for making a study of this type?
3. List and describe the main items on which comparison is made.
4. Write a brief criticism of the method of direct comparison.

References

Mosher, M. L., and Case, H. C. M., *Second Annual Report of the Farm Bureau—Farm Management Service,* University of Illinois, 1926.

Mosher, M. L., Herrington, W. A., Fruin, E. G., and Case, H. C. M., *Twelfth Annual Report of the Farm Bureau—Farm Management Service,* University of Illinois, 1936.

Nourse, E. G., *Agricultural Economics.* Chicago: The University of Chicago Press, 1916, pp. 395–398.

U. S. Department of Agriculture, *Department Bulletin 920,* "Farm Profits," by H. M. Dixon and H. W. Hawthorne. 1920.

U. S. Department of Agriculture, *Farmers' Bulletin 1139,* "A Method of Analyzing the Farm Business," by H. M. Dixon and H. W. Hawthorne. 1920.

U. S. Department of Agriculture, *Farmers' Bulletin 1121,* "Factors That Make for Success in Farming in the South," by C. L. Goodrich. 1920.

CHAPTER VIII

The Standard Combination of Farm Enterprises

THERE is one major objection to the methods of substitution and comparison, namely, that farmers cannot, without considerable help, experiment with all sorts of enterprise combinations. It is difficult to get them to make even the simple and obvious changes in their organization. They need a few standard enterprise combinations which are applicable *to their conditions and to their own resources*, that is, combinations set up so that they can see how the various enterprises fit together, what will be the probable financial results, and how the changes can be made and the new combinations put into practice. The purpose of this chapter and of Chapter IX is to show how such standard combinations may be developed and used by farmers in improving the organization of their farms.

1. The Kind of Information Needed

In every well-established agricultural area there are certain enterprises which farmers have found best suited to conditions of their soil and climate, or there are certain crops and classes of livestock which farmers have found to be most profitable. As this subject has been discussed at length in Chapter IV, it is not necessary in this connection to discuss why this is true. The chief task is to select from the various enterprises that are or can be handled profitably those which will give the maximum net returns for the farm as a whole. Evidently in making a selection of this sort, it is necessary to study the organization of representative farms[1] and to obtain such other data regarding the area as may be necessary to set up the most profitable combination of enterprises. Such a study must involve the gathering and the analyzing of the following information:

A. For the representative farms:
   1. An inventory of all farm property at the beginning and end of the year.
   2. An accurate detailed map for each farm showing:
      a. The size, shape, and position of each field.
      b. The position of the fences, field lines, ditches, and roads.
      c. The location of the buildings.
   3. A crop history of the crops produced on each field for a period of five years.
   4. A daily record of the receipts and expenditures.
   5. A daily record of all farm labor by principal operations or tasks.
   6. A monthly feed statement by classes of livestock.
   7. A monthly statement showing farm products used in the home.

B. For the area:
   1. Prices of crops, livestock, and livestock products for a period of years.
   2. Data on recent changes in acreage of the principal crops and in the number of the different classes of livestock.
   3. Data on the available resources, such as labor, land, and equipment.
   4. Experimental data for the area showing the effect of variations in the kind and quality of fertilizer on crop production.
   5. Experimental data showing the effect of various crop rotations on crop yields.
   6. Experimental data showing the effect of feed practices on livestock production.
   7. Farm management survey for a large number of farms showing the effect of farm practices and methods on crop yield and livestock production.

2. The Analysis of Data

When this information has been obtained, it is necessary to determine:

---

[1] By representative farms is meant those which are typical of the area as to size, soil types, topography, crops grown, livestock products produced, and farm practices followed.

a. Normal yields and prices for the various crops. Normal yields and prices are essential in projecting standard enterprise combinations, for these standards are set up from the long-time point of view; that is to say, combinations are selected which will be most profitable over a period of years. Hence, the desirability of having prices and yields which are normal rather than exceptional.

b. Production trend. For the purpose of projecting standard combinations of enterprises, it is important, of course, to determine the general movement in crop and livestock production. Unprofitable enterprise combinations are made up in part of enterprises which are no longer profitable or are becoming less and less profitable. A standard combination must be based not only on those enterprises which are profitable at the time the standard is projected but on enterprises which are most likely to be profitable in the future. A study of trend in the crop acreage and in the number of livestock will aid in deciding which enterprises should be selected.

c. Labor and material inputs for the various crop and livestock enterprises. Information on this subject may be subdivided as follows:

(1) Man labor inputs by operations.
(2) Horse labor (hours) by operations.
(3) Power inputs, other than horse power, by operations.
(4) Fertilizer inputs for each crop.
(5) Seed inputs for each crop.
(6) Feed requirements for each class of livestock.

From this information may be calculated normal labor and material input requirements for each farm enterprise.

d. Distribution of the man and horse hours used in the production of the various crops and classes of livestock. This must be done by farm operations. Such information is needed to determine how the various enterprises fit together and to determine what are the normal labor and power requirements for each enterprise.

e. The farm practices and methods peculiar to the area. A well-considered standard farm organization cannot be developed unless the economist is familiar with the farm practices peculiar to the area for which the standards are intended. A statement of the practices followed in the production of each crop and livestock product should be prepared. Note the following, taken from *Minnesota Bulletin 205,* page 46:

> Rye differs from the other grain crops grown in the Windom area in that it is seeded in the fall. All ground for rye is plowed. Only a small part of it is disked. All is harrowed at least once and some of it twice before planting and most of it is harrowed again after seeding. All is sown with a drill. Rye usually ripens a week earlier than oats and several days earlier than barley. It is either shock threshed or stack threshed, according to the practice of the farm.

3. The Development of the Standards

If the facts have been gathered and analyzed in the manner outlined above, standard farm organizations may then be developed. The various steps are:

a. Group the farms studied according to size.[2] A study of these groupings will usually show that farms having approximately the same available resources vary markedly in their net returns. In any given year these variations may be due to a number of causes: (1) variation in prices from farm to farm for similar products, (2) differences in yields, (3) variations in the efficiency of the management, and (4) variations in the crop-livestock combination.

b. Select from each size group those farms which appear to have the best organizations or those farms which are apparently utilizing the available resources to the best advantage. The final selection may be facilitated by an examination of labor distribution charts. These charts should show the actual man and horse hours distribution by enterprises and also the labor available. These charts will indicate to what extent the labor resources are being utilized.[3] (See Figures 17 and 18.)

---

[2] Probably the area devoted to crop production in most cases will prove the best measure of size.

c. Develop a cropping system. Next, attention should be given to the development of a cropping system. For this task the organization of the better farms may be used as tentative guides. In developing the cropping system the kind, that is, the class, of livestock and the amount of each class which is to form a part of the organization should be kept in mind.

The information relative to the farm practices should be reviewed in order to make use of the best practices and methods found in the area. For example, a better cropping system than is commonly used might be set up if farmers would do more fall plowing, if fall plowing is possible and at the same time a desirable practice. Or, the practice of handling some crops might be possible in the area but used only in a limited way. The change in practice might permit the establishment of a better cropping system. All of the possibilities should be carefully explored and utilized to the extent permitted by the general experience of the farmers. In no case will it be advisable to vary far from the general accepted practices and methods. Yet, in many instances, there may be practices and methods which can be utilized to an advantage, even if they are not commonly employed.

There are many factors which may affect the rotation in addition to farm practices. It is not advisable, as a general rule, to maintain year after year the same acreage for each crop in the rotation. Changes in economic conditions may be such that it will pay to increase the acreage of the principal crop. This may or may not involve a change of the minor crop, but it usually will. Rigidity is to be recommended only in those cases when prices of the principal crop do not change greatly from year to year, or when the farmer does not know how to adjust his acreage so as to take advantage of price and cost changes. Many farmers react to prices at planting time and as a result do the wrong thing; that is, they may increase their acreage of a given crop when it would be better to decrease it or to keep it constant. In such cases, a constant acreage for each crop in the rotation is clearly advisable, but a little reflection indicates that such a policy is not the most profitable one.

---

[3] The standard for any size group cannot, of course, use more resources than are normally available. This may be criticized from the point of view of economic theory, inasmuch as factors cannot be considered as fixed absolutely. But without attempting to answer this criticism, it may be said that for any given year the farmer may project his organization and estimate, as best he can, the resources which he will need. The resources of each group of farms give a tentative basis at least for estimating resources required for a standard. True, a better crop-livestock combination might be devised by using, in some cases, more of some one or several of the resources.

In addition to basing the cropping system on and in accordance with the best practices of the area, there are certain points which may be observed:

(1) Ordinarily, unless the experimental data indicate otherwise, alternate leguminous and nonleguminous crops.

(2) Alternate, unless there is a good reason or reasons for not doing so, deep-rooted and shallow-rooted plants.

(3) Avoid, as far as possible, leaving land fallow. Follow a fall-sown crop by a spring-grown crop.

(4) Include in the rotation one or more clean-cultivated crops for the purpose of controlling weeds.

(5) Include, in most regions, a sod-producing crop.

d. Determine man and horse labor requirements. When the standard system has been projected, the man and horse hour requirements for each crop should be charted. The total labor requirements should be checked against the man and horse labor normally available. It will be found usually that some adjustments in the crops will have to be made in order to avoid producing more of one crop than can be successfully handled by the available resources (mostly labor) at the peak load; or it may be found, on the other hand, that adjustments need to be made in order to use more completely the available labor supply.

e. Give the material requirements. A table showing the normal fertilizer, seed, and other material requirements should be prepared. The fertilizer requirements in any actual case will not, of course, correspond to the requirements shown in such a table, but the table will serve as a guide for the farmer whose soil and other conditions are typical. The closer these standard requirements are to the conditions of any given farm, the more useful they will be. Some farmers may find that more or less fertilizer than suggested would be advisable for their particular conditions. Such variations will always exist, and farmers should be encouraged to adjust their input factors to correspond as closely as possible to those which will give the best results. In making these adjustments, farmers will find the standard requirements helpful, since they are based upon the experience of actual farmers modified in the light of experimental data and of a study of the best methods and practices.

f. Project the probable crop production. The probable crop production for the standard combination may be projected by using normal yields. Yields, of course, will vary from year to year. In some years the actual yield will be less and some years greater than normal. But, except in the case of feed crops, this will not be significant. In determining the amount and kind of livestock for the standard organization, some allowance should be made for the probable annual variation in yields of feed crops. The farmer may find it advisable to carry over or to sell some feed crops when he produces more feed than is required when yields are above normal and to buy feed crops when the yields are below normal. In years of large crops the animals such as hogs may be kept on feed longer than when feed is scarce. Whether or not such a practice will be profitable will depend upon the price of the animal products and the price of feed. When feed is cheap relative to price of animal products, it may pay to feed animals to heavier weight.

If farmers cannot, or do not wish to, adjust their feeding period, then they might adjust their livestock to the feed supplies. In years of heavy crop production, some adjustments may be made by purchasing or by raising additional livestock. In most communities this method has a limited use unless the crop shortage or surplus is peculiar to individual farms. If crop shortage or surplus is general, all farmers will be face to face with the same problem at the same time. When this is true, farmers will find it more difficult to adjust their livestock to the supply of feed crops.

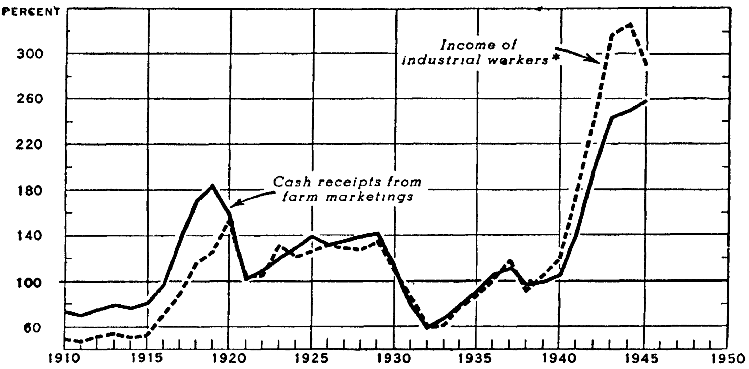
g. **Determine the amount and kind of livestock, if any, which is to form a part of the standard system.** The relationship between the crop and the livestock enterprises is indicated in the previous section. It is evident that the distribution of these two classes of enterprises must be worked out simultaneously. In deciding the amount and kind of livestock which should be maintained, the organization of the successful farms should be used as tentative guides. Minor adjustments, of course, will be necessary and can readily be made. When the best combination, or what appears to be the best combination, has been decided upon, the amount and kind of livestock should be presented in tabular form.

The number of animals in each class of livestock will depend upon the amount and kind of feed available and the technical efficiency of the production. With a given amount of feed available, the higher the requirements (inputs) per animal unit, the lower the number of units. The feeding requirements should be carefully worked out, and in no case should they depart far from the farmer's general experience. It is well understood that as feed inputs are increased, the resulting animal product will increase, but not necessarily, of course, at the same rate as the inputs increase. In the selection of the feed requirements, experimental data, whenever available, should be used. But in general the data are best presented as normal requirements for normal production or output.

h. **Determine the net income of the proposed organization.** The final test of any enterprise combination is the

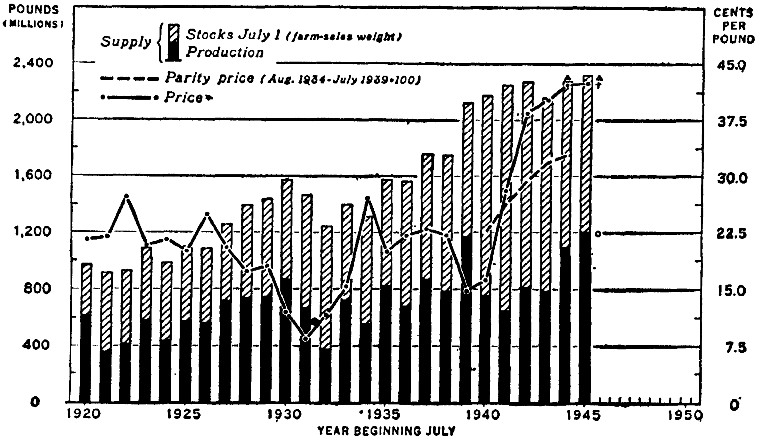
CASH RECEIPTS FROM FARM MARKETINGS, AND INCOME OF INDUSTRIAL WORKERS, UNITED STATES, 1910-45

INDEX NUMBERS (1935-39=100)

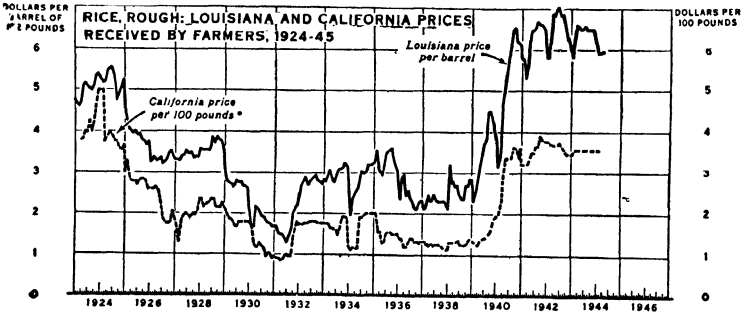


*MANUFACTURING, MINING, AND RAILWAY DATA FOR 1945 ARE TENTATIVE ESTIMATES

FLUE-CURED TOBACCO: SUPPLY AND PRICE IN THE UNITED STATES, 1920-45



• SEASON AVERAGE PRICE RECEIVED BY FARMERS ◆ PRELIMINARY † ESTIMATED • INDICATED OCT. 1

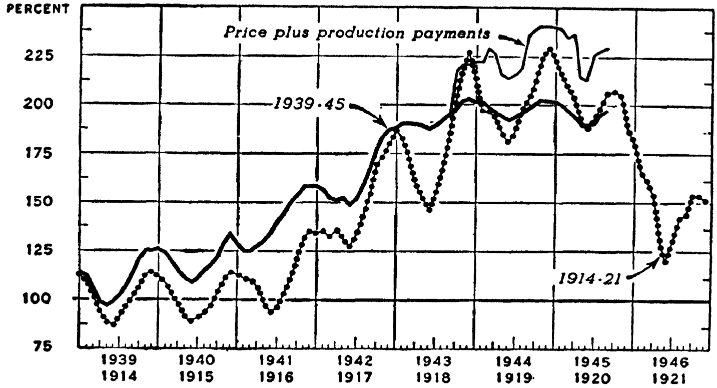


* PRICE OF CALIFORNIA PADDY f. o. b. WAREHOUSE PRIOR TO JANUARY 1938

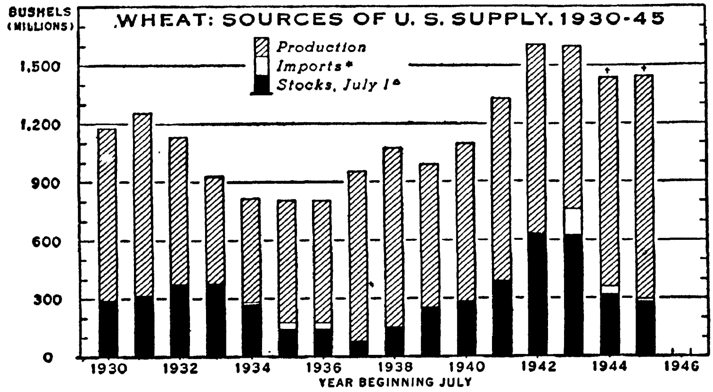
Fig. 16. Correct price and production data are essential if

DAIRY PRODUCTS: PRICES RECEIVED BY FARMERS, UNITED STATES, BY MONTHS, 1914-21 AND 1939-45

INDEX NUMBERS (AUGUST 1909-JULY 1914=100)



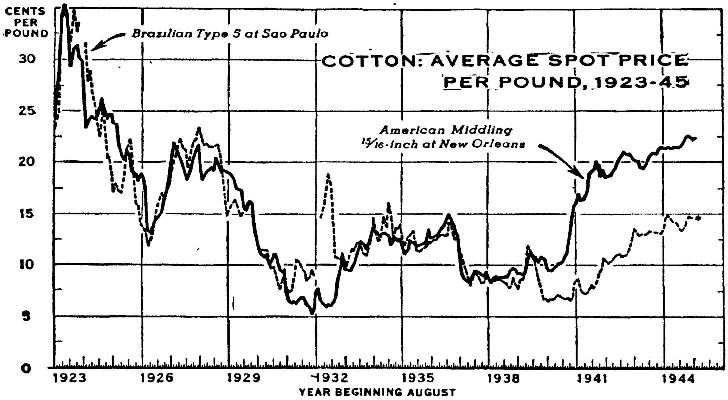
WHEAT: SOURCES OF U. S. SUPPLY, 1930-45



*IMPORTS FOR DOMESTIC UTILIZATION △1930-36 INCLUDES SOME NEW WHEAT

†PRELIMINARY

COTTON: AVERAGE SPOT PRICE PER POUND, 1923-45



*PRELIMINARY

the most profitable combination of enterprises is to be obtained.

net income. The net income of the projected organization may be shown by the income statement. This statement consists of a list of items indicating the income of the organization and a list of items indicating the expenditures. The income is calculated by multiplying normal production by normal prices. The expenditures are calculated by applying normal cost rates to the items of variable inputs, such as fertilizer, hired labor, and feed. The difference between the total income and outlay is the farm income and indicates the profitableness of the enterprise combination under conditions of normal yields and prices and with normal technical efficiency in production.

In preparing the income statement, it is not necessary to evaluate the family's or operator's labor or to include an item for interest on investment. Family labor and operator's labor are very difficult to evaluate, and their exclusion from the expense items can make no difference whatever with the results, nor can they affect the conclusions drawn relative to the effectiveness of the standard organization. As interest on investment is an arbitrary figure, its inclusion or exclusion will not affect the results.

The income of the standard may be compared with the income of the successful farms having approximately the same available resources. The comparison may suggest certain modifications which should be made in the standard. If changes are made, a new income statement should be prepared. It often happens that a change which may appear to be desirable does not add materially to the net income and may not be worth while.

4. The Usefulness of Standards

The usefulness of the standard will be more fully discussed in the following chapter. In concluding this discussion, all that needs to be said is that the standard organizations represent the best possible combinations of enterprises which can be projected on the basis of normal conditions. These standards are combinations of enterprises for a given amount of available resources. That is, the land is fixed and the amount of labor is that amount which is normally available to farmers operating a given size of farm. The equipment is that which is normally required to operate a farm of a fixed crop acreage. In setting up the standards, the best methods and practices are utilized only to the extent that farmers will readily accept them. They are flexible in that there is a standard for each major size group. With a change in the resources available there is a change in the crop combination. It is assumed that the management is the same as far as efficiency is concerned—a weakness of course but not a serious one. Variations in capacity are provided for by setting up standards for varying size groups; that is, it is assumed that a man who can operate a sixty-acre farm has more capacity than a man who can operate a forty-acre farm. These standards, therefore, supply a pattern for farmers having a certain combination of resources by which they can modify their crop-livestock combination in order to obtain the maximum long-time net income.

Questions

1. If a survey were to be made of a given area in order to set up a standard farm for that area, what information would you suggest that the survey include?

2. If you were considering corn as a major enterprise, what specific facts would you need to know about it? Beef cattle?

3. With a survey completed and the data in hand, what steps would you then take in setting up the standards?

4. State the advantages and disadvantages of a rigid scheme of rotation.

5. State the general rules to be followed in setting up a crop rotation scheme.

6. What is the final test of any combination of enterprises?

7. Wherein is this standard flexible? Wherein fixed?

References

North Carolina Agricultural Experiment Station, *Bulletin 252*, "Profitable Farm Combinations," by G. W. Forster and R. J. Saville, 1927.

North Carolina Agricultural Experiment Station, *Bulletin 260,* "Systems of Livestock Farming for the Mountain Region of North Carolina," by R. J. Saville, 1928.

North Carolina Research Bulletin 1, "Profitable Farm Organizations for the Coastal Plain of North Carolina," by G. W. Forster, R. J. Saville, and J. B. Hutson, 1926.

South Dakota Agricultural Experiment Station, *Bulletin 235,* "Profitable Farming Systems for the Intensive Spring Wheat Area in South Dakota," by C. A. Bonnen and R. H. Rogers, 1928.

Texas Agricultural Experiment Station, *Bulletin 395,* "Systems of Farming for the Black Waxy Prairie Belt of Texas," by L. B. Gabbard, J. B. Hutson, and T. L. Gaston, 1929.

CHAPTER IX

Using the Standard Systems[1]

THE purpose of developing the standard systems, discussed in the last chapter, is to enable farmers to adjust their farm business to a more profitable basis. This method has one advantage over other methods. It gives the farmer, at a glance, a notion of how the various farm enterprises for a given set of resources should be associated or combined. It is obvious that the usefulness of this method, in any given case, will depend upon the similarity of the resources of the farmer and of the resources used in developing the standard. Comparisons for the purpose of making adjustments should be made, therefore, between the actual organizations and the standard developed from similar resources; that is to say, the land in crops, the available labor, capital, and other factors should be the same or similar in both cases. As a general rule, the more nearly alike the resources the more useful the standard will be.

1. A Standard Forty-Acre Farm[2]

The usefulness of the standard in adjusting enterprise combinations may be made clear by a concrete illustration. For this purpose a standard forty-acre farm will be used.

a. Resources. Inasmuch as the actual farm to be reorganized is approximately forty acres, it will be necessary to describe briefly the organization of a standard forty-acre farm. In the area in which the farm is located, a forty-acre farm is normally operated by two men, or by family labor, including that of the operator, equivalent to two men, or approximately 4,500 hours of man labor. Two mules or two horses are required to do the farm work. Buildings required, other than the dwelling, consist of one small stock barn, four hog houses, one poultry house, and one machine shed. The farm machinery and tools needed for such a standard are listed in detail in Table 27. The total investment in physical resources is $14,615. (See Table 28.)

---

[1] Information in this chapter is taken from the North Carolina Experiment Station, *Bulletin 277,* "Planning the Farm Business," by G. W. Forster.

[2] In this chapter the acreage in crops is considered the measure of the size of the farm. Some additional land will be necessary for buildings, yards, lots, and pastures. Practically all of the farms in the area have some land already in pasture or have land available which can be used for this purpose.

b. Cropping system. The cropping system suggested is presented in Table 29. It consists of 8 acres of cotton, 10 acres of peanuts, 20 acres of corn and soybeans, and 2 acres of oats followed by soybeans for hay. Rye, lespedeza, or vetch is suggested as a cover crop and should be grown on at least one fourth of the crop area each year.

This disposition of the crop area is somewhat different from that of farms of this size. Normally, cotton occupies about 40 per cent of the crop area. In the case of the standard, the cotton acreage has been reduced to 20 per cent. Peanuts, the principal cash crop, usually occupy 25 per cent of the crop area. This same percentage has been maintained for the standard. Corn, on the other hand, occupies about 30 per cent of the area, but in the standard it has been raised to 50 per cent.

These changes call for a word of explanation. Cotton acreage has been reduced because cotton prices had shown a tendency to decline when this standard was designed, and it was believed that this tendency would continue; or at least cotton prices would remain at relatively low levels. On the other hand, while prices of peanuts have been declining, the rate of decline has not been as rapid as that in the case of cotton. Furthermore, there is need for more livestock, especially hogs and poultry, on most farms in the area; hence, the corn acreage has been increased to maintain a somewhat larger number of animals.

TABLE 27
Implements Needed on Standard Farms

Kind	*40-Acre*		*60-Acre*		*90-Acre*	
	No.	*Value*	*No.*	*Value*	*No.*	*Value*
Work harness	2	$25	3	$37	4	$50
Collars	2	9	3	14	4	18
Corn planter	1	14	1	14	1	14
Cotton planter	1	14	1	14	1	14
Peanut planter	1	14	1	14	1	14
Fertilizer distributor	1	7	1	7	2	14
Lime spreader	1	48	1	48	1	48
2-H stalk cutter	1	50	1	50	1	50
Corn sheller	1	13	1	13	1	13
Cotton plow	2	8	2	8	2	8
Weeder	1	10	1	10	2	20
1-H cultivator	2	11	3	16	2	11
2-H cultivator	1	42	1	42	2	84
1-H breaking plow	2	15	2	15	2	15
2-H breaking plow	1	15	1	15	2	30
2-H wagon and box	1	88	1	88	1	88
Cart	1	10	1	10	1	10
2-H disk harrow	1	45	1	45	1	45
2-section spike-tooth harrow	1	16	1	16	1	16
Mower	1	65	1	65	1	65
Hay rake	1	33	1	33	1	33
Hay rack for wagon	1	10	1	10	1	10
Manure spreader	....	....	....	....	1	120
Minor equipment:						
Hoes	6	6	8	8	9	9
Hand rake	1	1	2	2	2	2
Pitchfork	3	3	3	3	4	4
Shovel	1	1	2	3	2	3
Spade	1	1	1	1	1	1
Scythe	1	3	2	6	2	6
Posthole digger	1	2	1	2	1	2
Staple puller	....	....	1	1	1	1
Wire stretcher	1	10	1	10	1	10
Carpenter's tools (set) (Hammer, hatchet, brace and bit, square, saw, wood chisel, cold chisel, wire cutters, level, plane, files, etc.)	1	50	1	50	1	50
Machine wrenches (set)	....	....	1	3	1	3
Pipe wrenches	....	....	1	1	2	2
Wedge	1	1	1	1	2	1

TABLE 27—(Concluded)

Kind	*40-Acre*		*60-Acre*		*90-Acre*	
	No.	*Value*	*No.*	*Value*	*No.*	*Value*
Cream separator	....	....	1	$60	1	$69
Cream cans	....	....	2	2	3	3
Grindstone	1	$5	1	5	1	5
Maul	1	1	1	1	2	2
Axe	2	3	2	3	3	4
Crosscut saw (5½ ft.)	1	5	1	5	1	5
Anvil and vise	1	4	1	4	1	4
Platform or balance scales (500#)	1	16	1	16	1	16
Log chain (15′ x 20′)	1	2	1	4	2	5
Ladder (20 ft.)	1	6	1	6	2	12
Stepladder (6 ft.)	1	2	1	2	2	5
Corn knife	1	1	1	1	2	1
Lantern	1	1	2	3	2	3
Grub hoes (set)	1	1	1	1	1	1
Wheel barrow	1	5	1	5	1	5
Total	.....	$692	.....	$793	.....	$1,024

TABLE 28

ESTIMATED INVESTMENT FOR STANDARD FARMS

Crop Land	*40-Acre*	*60-Acre*	*90-Acre*	*Farm "A"*
Land	$10,000	$15,000	$22,500	$ 8,000
Buildings	3,000	3,500	4,000	4,765
Livestock	800	1,400	1,700	770
Machinery and tools	700	800	1,000	600
Feed	115	200	250	132
Total	$14,615	$20,900	$29,450	$14,267

c. Utilization of labor. Attention has been directed thus far to the utilization of the crop land. A word should be said about the utilization of the labor supply. Because of seasonality of agricultural production, it is difficult to suggest systems which will utilize all of the available labor economically, and it should be emphasized that the object in setting up these standards is not to attempt to use all of the available labor unless it can be done economically.

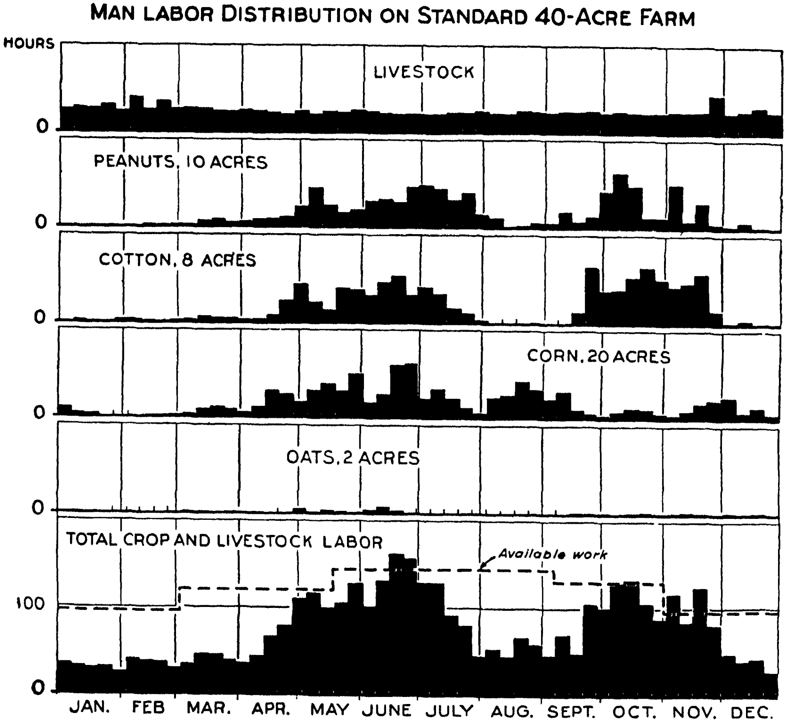
TABLE 29

Crop Rotation for Standard 40-Acre Farm

Field A:		
First year:		
Cotton	8 A	Vetch or rye 8 A[a]
Oats	2 A	Soybeans for hay 2 A
Second year:		
Peanuts	10 A	Vetch or rye 10 A
Third year:		
Corn	10 A	(Soybeans planted with corn)
Fourth year:		
Corn	10 A	
Field B:		
First year:		
Peanuts	10 A	Vetch or rye 10 A
Second year:		
Corn	10 A	(Soybeans planted with corn)
Third year:		
Corn	10 A	
Fourth year:		
Cotton	8 A	Vetch or rye 8 A
Oats	2 A	Soybeans for hay 2 A
Field C:		
First year:		
Corn	10 A	(Soybeansplanted with corn)
Second year:		
Corn	10 A	
Third year:		
Cotton	8 A	Vetch or rye 8 A
Oats	2 A	Soybeans for hay 2 A
Fourth year:		
Peanuts	10 A	Vetch or rye 10 A
Field D:		
First year:		
Corn	10 A	(Soybeans planted with corn)
Second year:		
Cotton	8 A	Vetch or rye 8 A
Oats	2 A	Soybeans for hay 2 A
Third year:		
Peanuts	10 A	Vetch or rye 10 A
Fourth year:		
Corn	10 A	Soybeansplanted with corn

[a] These are cover crops planted after the cotton or peanuts have been harvested.

Figures 17 and 18 show the distribution of man and horse labor and the extent to which the total available labor may be utilized. A more even distribution of this labor throughout the year might be obtained by reducing the acreage in the major crops and by increasing the corn and hay crops and the number of livestock. But to do this would reduce the net income, because, in this area, cotton and peanuts are normally more profitable than corn and hogs or dairy cattle. Hence, under the system of farming practiced, it is impossible to use all of the available labor. However, a fairly satisfactory use has been made of the labor, and probably the standard suggested provides for the utilization of all labor to a greater extent than the enterprises

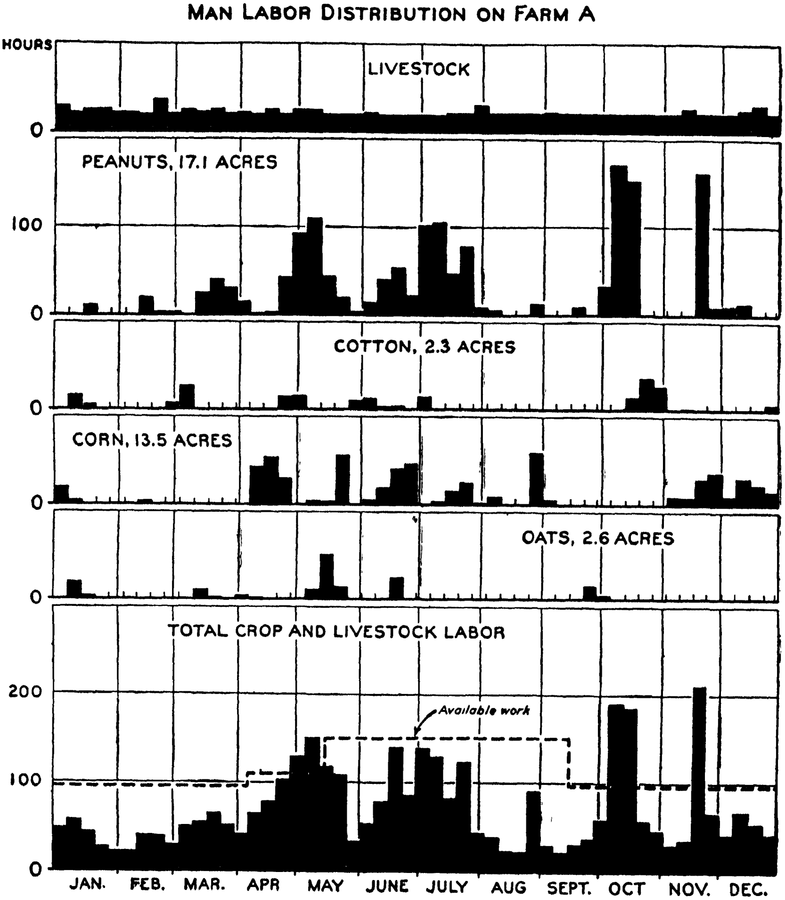


Courtesy of N. C. Agr. Exp. Sta.

Fig. 17. The monthly distribution of man labor on a standard forty-acre cotton and peanut farm.

used by the majority of farms of this size in the area. Certainly the standard suggests a better utilization of the labor than Farm "A" to be described. (Compare Figures 17 and 18.)

d. Yield and production. The cropping system will, when the amounts and kinds of fertilizer recommended are used, result in yields somewhat above the average for the area. The fertilizers suggested are based in part upon ex-



Courtesy of N. C. Agr. Exp. Sta.

Fig. 18. The monthly distribution of labor on a forty-acre cotton and peanut farm located in the coastal plain of North Carolina.

perimental data and in part upon the experiences of the more successful farmers. The amounts per acre and the grades of fertilizers recommended are 800 pounds of 5–8–3 on cotton, 200 pounds of 2–8–4 on peanuts, 500 pounds of 6–6–3 and 50 pounds of soda on corn, and 400 pounds of 5–6–3 on oats. It is recommended that 200 pounds of land plaster be applied to peanuts at blooming time. (See Table 30.)

The yield objective (see Table 31) is one bale of cotton per acre, 1,800 pounds of peanuts, 35 bushels of corn, and two tons of hay. These yields are not impossible, as farmers in the area have obtained yields for specific crops as high as or higher than those suggested in the standard. Experimental work on similar soils has demonstrated that these yields are more economical than those generally obtained by farmers. Most farmers in the area use a 3–8–3 mixture on all crops. For cotton production a side dressing of soda is made in addition to the 3–8–3 used under the crop. This practice is followed also with regard to corn, although it is not as general as in the case of cotton. The object of the side dressing is to add additional units of ammonia. While this practice is not wholly bad, it is believed that the fertilizers suggested above will give more economical yields.

Cotton yields are, of course, dependent also upon the control of the boll weevil. This insect has been very damaging in some seasons, reducing yields materially. Dusting, the common method of control suggested, is not often practiced in this area. It would seem, however, from experimental work that has been carried on that the control of the boll weevil is possible. It is recommended, therefore, that in addition to using the combination of enterprises and fertilizer practices suggested, farmers include in their practice dusting for the control of this pest. In dusting it is advisable for farmers to employ the most approved methods.[3]

---

[3] For more specific information the reader is referred to *Leaflet No. 27* issued by the United States Department of Agriculture. This leaflet gives the amount to be applied per acre, dusting equipment, and the cost of application.

TABLE 30

SUGGESTED FERTILIZER AND SEED REQUIREMENTS FOR STANDARD 40-ACRE FARM[a]

Crops	*Acres*	*Fertilizer*			*Seed*	*Cost*		
		Formula	*Amount per Acre*	*Total Amount*		*Seed*	*Fert.*	*Total*
Cotton.....	8	5–8–3	800 lb.	6,400 lb.	8 bu.	$5	$99	$104
		Soda	100 lb.	800 lb.	@60¢	......	21	21
Peanuts....	10	2–8–4	200 lb.	2,000 lb.	165 lb.	8	22	30
		Plaster[b]	200 lb.	2,000 lb.	@5¢	......	......	......
Corn.......	20	6–6–3	500 lb.	10,000 lb.	3 bu.	......	165	165
		Soda	50 lb.	1,000 lb.	@$1	3	26	29
Oats.......	2	5–6–3	400 lb.	800 lb.	6 bu.	5	12	17
					@80¢			
Rye........	10	....	....	....	20 bu.	50	......	50
					@$2.50			
Total...	......	....	....	....	....	$71	$345	$416

[a] The fertilizer recommendations for the area to which this system of farming applies may vary somewhat from farm to farm.

[b] To be put on at blooming time.

TABLE 31

PROBABLE PRODUCTION AND DISPOSITION OF CROPS AND LIVESTOCK PRODUCTS ON STANDARD 40-ACRE FARM

Product	*Units*	*Acres*	*Yield*	*Production*	*Disposition*	
					Sale	*Farm Use*
Cotton lint........	lb.	8	500	4,000	4,000	......
Cotton seed........	lb.	....	1,000	8,000	7,650	350
Peanuts...........	lb.	10	1,800	18,000	17,800	200
Corn..............	bu.	20	35	700	75	625
Oat hay...........	tons	2	2	4	....	4
Soybean hay.......	tons	2	2	4	....	4
Peanut hay........	......	....	....	....	To be used as needed	
Whole milk........	lb.	....	480	(B.F.) 300	....	180
Pork (live weight)..	lb.	....	....	7,200	6,600	600
Eggs..............	doz.	....	....	625	525	100
Poultry (dressed)...	lb.	....	....	625	475	150

e. Prices. The prices used, with respect both to products intended for sale and to things purchased, are based on the market trends. These prices may be considered, roughly, as normal or long-time prices.

f. Livestock production. The question of how many head of livestock should be maintained is always an important one. In projecting the cropping system and the amount and kind of livestock, the objective is to set up that combination of livestock and crop enterprise which will result in the maximum net returns for the farm business as a whole. The number of livestock suggested for the forty-acre standard is, in addition to two units of workstock, 2 dairy cows, 3 sows, 36 shoats, and 125 hens. (See Table 32.) This number of livestock per farm of this size is somewhat larger than that followed in the area. It appears, however, that livestock production is under-emphasized and that a moderate increase would be profitable. In attempting to decide upon the amount of livestock to be maintained in any given case, the farmer should remember that the number and kind of livestock cannot be determined independently of the cropping system.

TABLE 32

SUGGESTED LIVESTOCK FOR 40-ACRE STANDARD FARM

Class	*Number*	*Animal Units*
Workstock	2	2
Dairy cows	2	2
Sows	3	1
Shoats	36	7.20
Poultry	125	1.25
Total animal units		13.45

A further question is raised—whether to sell feed crops or to dispose of them through livestock. This may be illustrated by considering the relation between corn and hogs. Corn may be sold as grain or used as feed. The general experience in the area is in favor of hogs as the best type of livestock to utilize this crop, although to a limited extent dairy cattle may be used for this purpose. In either case, should the farmer feed all of his corn, or would it be more profitable for him to feed a portion and sell the remainder, or to sell all above that needed for workstock? The decision in this matter will depend upon the prices of corn on the one hand, and the price of pork and dairy products on the other. It would probably pay to feed most of the corn when prices for hogs and dairy products are similar to those which have been used in the standard. The question of the disposition of the corn crop is one which cannot be settled once for all. The farmer, therefore, needs to give attention to the anticipated market demands for corn and for dairy products and hogs. This question is discussed more fully in Chapter IV.

g. **Disposition of feeds.** Table 33 shows the disposition of feeds to the different classes of livestock on the standard forty-acre farm. The way in which these feeds have been distributed does not provide ideal rations. However, an attempt has been made to provide rations which are in line with the farmer's experience. Better rations could be provided if more purchased feeds were used, but the question arises as to how much feed, in any given case, a farmer is willing or able to purchase. It is obvious that it is useless to suggest a ration which would probably not be used by the farmer. This question, together with the question of kind and amount of fertilizer used, is partly a technical as well as an economic problem. Therefore, it is suggested that the student, when using this method, consult the various publications available on these subjects.[4]

TABLE 33

SUGGESTED DISTRIBUTION OF FEED TO LIVESTOCK ON STANDARD 40-ACRE FARM

Feed	*Units*	*Workstock*	*Cattle*	*Hogs*	*Poultry*	*Total*
Corn	bu.	100	30	420	30	580
Fish meal	lb.	...	...	2,000	.....	2,000
Middlings	lb.	...	...	2,000	.....	2,000
Poultry feed	lb.	...	...	.....	1,000	1,000
Oat hay	tons	2	2	.....	.....	4
Soybean hay	tons	2	2	.....	.....	4
Peanut hay	To be fed as needed.					
Peanut gleanings	To take the place of 40 bu. of corn.					
Skim milk	To be fed to hogs and poultry as available.					
Soybeans	To be pastured down by hogs.					
Rye	To be pastured.					

Inasmuch as yields will not be the same from year to year, it may be desirable to carry over a small amount of feed from years when crops are good. In other cases, it may be desirable to buy a small amount of feed in some years and to sell a small amount in other years. Such adjustments in feed supply will be necessary on practically all farms. The amount of feed suggested for the different classes of livestock is that amount which has been found to hold true for a number of farms in the area under investigation. Minor variations from the amount suggested will often be found advisable. *A good rule is to have some home-grown feed to sell, rather than to buy such feeds.* This rule has been followed in setting up this standard.[5]

---

[4] See *North Carolina Extension Circular No. 175*, pp. 74–95.

TABLE 34

PROBABLE FINANCIAL RETURNS FROM STANDARD 40-ACRE FARM

Receipts		*Expenses*	
Cotton 4,000 lb. @ 18¢	$ 720	Fertilizer	$ 345
Cottonseed 8,000 lb. @ 2¢	160	Seed	69
Peanuts 18,000 lb. @ 4½¢	810	Ginning, 8 bales @ $4.50	36
Corn 75 bu. @ $1.00	75	Dusting material for cotton	20
Pork 6,600 lb. @ 12¢	792	Picking peanuts, 200 bags @ 20¢	40
Butterfat 300 lb. @ 50¢	150	Peanut bags, 200 @ 15¢	30
Eggs 525 doz. @ 35¢	184	Feed bought	150
Poultry 475 lb. @ 22¢	105	Real estate expense	100
Products from farm used in home[a]	257	Equipment expense	50
		Auto expenses	50
		Taxes	130
		Miscellaneous	30
		Total	$1,050
		Farm Income	2,203
	$3,253		$3,253

Farm Income		$2,203	Farm Income		$2,203
Less estimated value of all unpaid family labor	$300		Less estimated value of all unpaid family labor	$300	
Less value of operator's labor	500	800	Less 5% on investment	750	
					1,050
Return on investment		$1,403	Labor and management wage		$1,153
Rate of return on investment		9.6%			

[a] Exclusive of garden products.

---

[5] Warren, G. F., *Farm Management*, p. 207. New York: Macmillan, 1916.

h. Financial returns. The income statement for the standard forty-acre farm is shown in Table 34. The farm income is $2,203; the rate of return on investment, 9.6 per cent; and the labor and management wages are $1,153.[6] The farm income is larger than that received by farmers in the area operating farms of this size. Among the chief reasons for this are: (1) A better utilization of the farm resources exists because of a better than average combination of farm enterprises; (2) the amount and analysis of fertilizer recommended are above the average; and (3) there is more livestock and a somewhat better grade than is found on most farms.

2. The Analysis of an Actual Farm

As it is the object of this chapter to show how standards may be employed for the purpose of improving existing farm organizations, it will be necessary to describe the organization and financial results of one of the better farms in this area and to compare the organization and financial returns of this farm with the organization and financial returns of the standard. Finally, this actual farm will be organized as suggested by the standard, and the effects on the returns of the farm will be noted.

a. Resources of Farm "A". The farm selected for this purpose will be designated as Farm "A", the organization of which is typical in many respects of farms of the same size found in the area. There are 156 acres, 40.3 of which were in crops distributed as follows: cotton, 2.26 acres; peanuts, 17.10 acres; corn and soybeans combined, 13.5 acres; oats, 2.59 acres; alfalfa, 3.364 acres; and miscellaneous crops, mostly truck and gardens, 1.469 acres.

The investment, at the beginning of the year, of $770 in livestock consisted of 2 mules valued at $350, 4 head of dairy cattle valued at $160, swine valued at $195, and poultry valued at $65. The real estate was estimated to be worth $12,765, of which amount $8,000 was invested in land; $600 was in machinery and tools; and $132 was in feed on hand. The total resources were valued at $14,267.

---

[6] See Chapter XI for a discussion of these concepts.

The farm was operated by the owner, assisted by two sons and some hired labor. The total labor annually available approximated 4,475 hours.

b. **Yield and production.** Detailed information regarding the cropping system, livestock, feeds, and production is given in Tables 33 to 36, inclusive. Table 35 gives the acres in each crop, yield per acre, total production, and disposition. The farm produced 1,074 pounds of cotton, 1,608

TABLE 35

PRODUCTION AND DISPOSITION OF CROPS AND LIVESTOCK PRODUCTS ON FARM "A"

Product	*Acres*	*Yield*	*Production*	*Disposition*	
				Sales	*Farm Use*
Cotton lint....	2.263	475 lb.	1,074 lb.	1,074 lb.	....
Cottonseed....	....	711.5 lb.	1,608 lb.	690 lb.	918 lb.
Peanuts.......	17.101	1,789 lb.	30,600 lb.	29,739 lb.	861 lb.
Corn and soybeans.......	12.503	33.2 bu.	415 bu.	....	415 bu.
Soybeans.....	1.014	....	40 bu.	....	40 bu.
Fall oats..... Spring oats...	2.586	2.3 tons	6 tons	....	6 tons
Alfalfa [a].......	3.364	....	....	....	....
Miscellaneous crops.......	1.469	....	....	....	....
Waste........	.132	....	....	....	....
Peanut hay....	....	....	3.5 tons	....	3.5 ton
Corn stover...	....	....	1 ton	....	1 ton
Butter........	....	....	206½ lb.	114½ lb.	92 lb.
Milk.........	....	....	9,163 qt.	2,695 qt.	6,468 qt.
Pork (live)....	....	....	3,474 lb.	3,200 lb.	274 lb.
Eggs.........	....	....	258 doz.	172 doz.	86 doz.
Poultry.......	....	....	441 lb.	312 lb.	129 lb.
	40.432				

[a] First year. This crop failed in 1928.

pounds of cottonseed, 30,600 pounds of peanuts, 415 bushels of corn, 40 bushels of soybeans, and 6 tons of oat hay. In addition to the oat hay, 3½ tons of peanut vines and 1 ton of stover were fed. The yields were, in the main, satisfactory and were somewhat above the average for the area.

The farm was somewhat more heavily stocked than the average farm of this size. There were 15.73 animal units, of which 2.5 units were workstock and 13.23 units were productive livestock. (See Table 36.) The production was fairly satisfactory. The livestock products amounted to an equivalent of 530 pounds of butterfat, 3,474 pounds of pork, 258 dozen eggs, and 441 pounds of poultry. (See Table 35.)

c. **Financial results.** The chief receipts were $1,487 from peanuts, $384 from pork, $270 from milk, $221 from cotton and cottonseed, $113 from poultry products, $42 from butter, and $51 from miscellaneous sales. (See Table 39.) Included in the receipts were farm products used in the home valued at $236, making a total income of $2,804.

The total operating expenses amounted to $1,014. The chief items were: fertilizer, $294; feed, $135; and taxes, $128.

The net farm income was $1,790; and the return to investment, $990, or at the rate of 6.9 per cent. The labor and management wage, that is, the payment of the operator for his labor and supervision, was $777.[7]

d. **Weakness of the present organization.** The organization of Farm "A" is not as well balanced as it might be, as too much emphasis has been given to peanut production. A better utilization of the resources can be attained by a

---

[7] The return to investment as calculated involves the assumption that the unpaid family labor and the operator's labor are actually worth $800. This assumption may or may not be correct. To the extent that it is incorrect, i.e., should be valued higher or lower, the net returns to investment will be larger or smaller than 6.9 per cent. The same weakness is involved in the calculation of the labor and management wage. In addition to estimating the value of unpaid family labor, the assumption has been made that the rate of return should be 5 per cent.

TABLE 36

Livestock Kept on Farm "A"

Class	*Animal Units*
Workstock	2.5
Dairy cattle	3
Other cattle	1
Sows	1.5
Hogs	1.8
Small pigs	5.1
Poultry	.83
Total animal units	15.73

TABLE 37

Distribution of Feed to Livestock on Farm "A"

Feed	*Units*	*Work-stock*	*Cattle*	*Hogs*	*Poultry*	*Total*
Corn	bu.	54	26	308	25	413
Fish meal	lb.	....	....	540	....	540
Middlings	lb.	....	550	1,250	... .	1,800
Poultry feed	lb.	....	....	....	940	940
Linseed meal	lb.	....	50	....	....	50
Cottonseed meal	lb.	....	2,060	....	....	2,060
Cottonseed hulls	lb.	....	1,300	....	....	1,300
Grain	lb.	....	....	....	270	270
Oat hay	tons	4.7	....	....	.18	4.88
Mixed hay	tons	.9	2.6	....	....	3.5
Corn fodder (green)	tons	....	....	1.35	....	1.35
Milk	gal.	. . .	300	180	840	1,320

reduction in peanut acreage and an increase in cotton and corn acreage. An increase in corn acreage would permit an expansion of the livestock, especially of the hog enterprise.

The yields, as already noted, are, as a rule, satisfactory. However, the grade of fertilizer used (3–8–3) is not now recommended for this area and for the crops grown. Better yields could be obtained by using 5–8–3 for cotton, 8–2–4 for peanuts, and 6–6–3 for corn. Indeed, these high grade fertilizers are now (1945) widely used in this area.

3. The Reorganization of Farm "A"

A comparison of the two organizations described above shows that there is a difference in the net farm income of

TABLE 38

FERTILIZER AND SEED USED ON FARM "A"

Crop	Fertilizer			Total	Seed	Cost of		Total
	Acres	Formula	Amount per Acre			Seed	Fert.	
Cotton	2.263	3-8-3	800 lb.	1,810 lb.	3.4 bu.	$2.04	$18.10	$26.36
		Soda	100 lb.	226 lb.			6.22	
Peanuts	17.101	Plaster	300 lb.	5,130 lb.	13 bu.	14.11	25.70	74.31
		Lime	403 lb.	6,900 lb.			34.50	
Corn and		3-8-3	750 lb.	9,464 lb.	C 13.5 pk.	3.38	94.64	
Soybeans.	12.503	Soda	108 lb.	1,352 lb.	S 13.5 pk.		37.18	135.20
Soybeans	1.014	Manure	4 ton	4 ton			14.00	14.00
Oats	2.586	Soda	97 lb.	250 lb.	4½ bu.	3.60	6.87	10.47
Alfalfa [a]	3.364	3-8-3	500 lb.	1,682 lb.	1 bu.	17.00	37.84	
		Manure		3 ton			10.50	72.84
		Lime		1,500 lb.			7.50	
Misc. [b]	1.469	Soda	48 lb.	48 lb.		6.40	1.32	7.72
Waste	.132							
	40.432					$46.53	$294.37	$340.90

[a] First year. [b] Orchard and garden.

TABLE 39

INCOME STATEMENT FOR FARM "A"[a]

Receipts			Disbursements		
Cotton, 1,074 lb. @ 19.27¢		$ 207	Fertilizer (see Table 36)		$ 294
Cottonseed, 690 lb. @ 2¢		14	Seed (see Table 36)		47
Peanuts, 29,739 lb. @ 5¢		1,487	Ginning, 2 bales @ $4.50		9
Pork (live), 3,200 lb. @ 12¢		384	Picking peanuts		80
Butter, 114½ lb. @ 36.7¢		42	Peanut bags, 340 @ 13.2¢		45
Milk, 2,695 qt. @ 10¢		270	Feed bought		135
Poultry, 312 lb. @ 23¢		72	Extra labor		80
Eggs, 172 doz. @ 24¢		41	Real estate		72
Miscellaneous		51	Equipment		32
Farm products used in home		236	Auto expenses		60
			Taxes		128
			Miscellaneous		32
			Total		$1,014
			Farm income		1,790
		$2,804			$2,804
Farm income		$1,790	Farm income		$1,790
Less value of unpaid family labor	$300 [b]		Less unpaid family labor	$300	
Less value of operator's labor	500 [b]	800	Less 5% on investment	713	1,013
Return on investment		$ 990	Management wage		$ 777
Per cent return on investment		6.9			

[a] This statement is based upon current production. [b] Estimated.

$413 in favor of the standard system. (Compare Tables 34 and 39.) The chief cause of this difference is the better combination of enterprises on the standard, in which more emphasis is placed on cotton production and less emphasis on peanut production. Also, more livestock is maintained on the standard than on Farm "A". While the yields are higher on the standard than on Farm "A", this does not greatly affect the net income. Prices are somewhat higher on Farm "A" than those used in the standard. The expenses are about the same for the two organizations.

To determine the effect of the combination of enterprises alone on returns, the effect of variations in yields, prices. and costs must be eliminated. This could be accomplished by using the same yields, prices, and cost rates for both the standard and Farm "A". But such a method would involve the assumption that the same labor, fertilizer, and other factors of production used would result in the same production on Farm "A" as on the standard. Obviously, this might not be true. The better way is to reorganize Farm "A" to correspond, as nearly as possible, to the standard farm, and then to use normal prices, the same fertilizer and labor inputs, and the same yields as those obtained on Farm "A". This will show the net effect of organization on the income This has been done, and the results are given in Tables 40 to 44.

In Table 44 the comparison is made between income statement of the original and Farm "A" reorganized. The net gain due to organization alone is $179. While this is not a large sum, it represents an increase in the capital value of the farm of approximately $3,600. Or, the increase of $179 in net returns means that the rate of return has been increased from 5.8 per cent (using normal prices) to 7.7 per cent, or a net increase of 1.9 per cent. It should be remembered, also, that the yields on the original farm might be improved somewhat by using the amounts and kinds of fertilizer suggested in the standard and also by increasing the quality of the livestock. Finally, by following the crop rotation suggested for the standard, the yields over a period of years could be increased without greatly increasing the expenses of the operation.

4. Criticism of the Standard Method

The standard method of selecting and combining farm enterprises is not above criticism. Frankly some students of farm management are skeptical of its usefulness. The criticisms are concerned chiefly with the apparent artificiality of the results and its theoretical deficiencies. The standards, it is argued, are not actual, but artificial, combinations of enterprises. This being the case, the farmers may be misled into devising plans for their own farms, based on some defective or artificial standard, which might be much less rather than much more profitable than the original. Although this criticism is valid, the critics have overlooked the primary purpose of the standards, which is to serve simply as a guide to the farmers and not to be adopted in toto. The farmer must, as an entrepreneur, use his experience and judgment in adopting a standard as a guide in developing a new plan for his farm. The author of this treatise has used the standard method for a number of years on his own farm and has found it not only reliable as a guide as to what can and should be done but also as a check on actual performances. Furthermore, it is helpful in establishing orderly procedures in management, especially when a plan based on the standard is accompanied by a detailed map of the farm.

It should also be mentioned that the standards are not as artificial as they may appear to be. The data used in developing the standards are obtained from a study of actual farms in a homogeneous area and from such experimental data as are available. Also the plans devised for a given area follow closely those actually in use by farmers. They are, then, in no real sense an artificial creation, but they are workable guides for the organization and management of farms having similar resources as the standard and following approved practices.

TABLE 40

PRODUCTION AND DISPOSITION OF CROPS AND LIVESTOCK PRODUCTS ON FARM "A" REORGANIZED

Product	*Unit*	*Acres*	*Yield*	*Production*	*Disposition*	
					Sale	*Farm Use*
Cotton lint	lb.	8	475	3,800	3,800	....
Cottonseed	lb.	....	711.5	5,692	3,272	2,420
Peanuts	lb.	10	1,789	17,890	17,000	390
Corn	bu.	18	33.2	597.6	60	537
Oats	tons	2	2.3	4.6	....	4.6
Soybeans	tons	2	2	4	....	4
Butter	lb.	....	....	206½	114½	92
Milk	qt.	....	....	9,163	2,695	6,468
Pork	lb.	....	....	4,524	4,250	274
Eggs	doz.	....	....	270	184	86
Poultry	lb.	....	....	457	328	129

TABLE 41

LIVESTOCK SUGGESTED FOR FARM "A" REORGANIZED

Class	*Number*	*Animal Units*
Workstock	2	2
Dairy cows	3	3
Sows	4	1.33
Shoats	48	9.6
Poultry	125	1.25
		17.18

TABLE 42

DISTRIBUTION OF FEED ON FARM "A" REORGANIZED

Feed	*Work-stock*	*Cattle*	*Hogs*	*Poultry*	*Total*
Corn, bu.	54	26	420	34	534
Fishmeal, lb.	....	....	2,000	....	2,000
Middlings, lb.	....	550	2,000	....	2,550
Poultry feed, lb.	....	....	....	1,000	1,000
Cottonseed meal, lb.	....	2,060	....	....	2,060
Oats, bu.	....	....	....	10	10
Oat hay, tons	2	2	....	.6	4.6
Soybean hay, tons	2	2	....	....	4
Milk, gal.	....	300	180	840	1,320
Peanut hay, tons	To be fed to livestock as needed.				
Peanut gleanings	To take the place of 40 bushels of corn.				

TABLE 43

Fertilizer and Seed Used on Farm " A " Reorganized

Crop	*Acres*	*Fertilizer*			*Seed*	*Cost of*		*Total*
		Formula	*Amount per Acre (Pounds)*	*Total (Pounds)*		*Seed*	*Fert.*	
Cotton	8	3-8-3	800	6,400	12 bu.	$7.20	$64.00	$92.20
		Soda	100	800			21.00	
Peanuts	10	Plaster	300	3,000	7.65 bu.	8.42	15.00	39.54
		Lime	403	4,030			16.12	
Corn	18	3-8-3	700	12,600	4.5 bu.	4.50	126.00	180.00
		Soda	100	1,800			49.50	
Oats	2	Soda	97	194	3.5 bu.	2.80	5.34	8.14
Rye	10				20 bu.	50.00		50.00
Total						$72.92	$296.96	$369.88

TABLE 44

Financial Statement for Farm "A" Original and for Farm "A" Reorganized [a]

	Original		*Reorganized*	
Receipts:				
Cotton lint	1,074 lb. @ 18¢	$ 193	3,800 lb. @ 18¢	$ 684
Cottonseed	690 lb. @ 2¢	14	3,272 lb. @ 2¢	65
Peanuts	29,739 lb. @ 4½¢	1,338	17,000 lb. @ 4½¢	765
Corn		..	60 bu. @ $1.00	60
Pork (live)	3,200 lb. @ 12¢	384	4,250 lb. @ 12¢	510
Butter	114½ lb. @ 45¢	52	114½ lb. @ 45¢	52
Milk [b]	2,695 qt. @ 10¢	270	2,695 qt. @ 10¢	270
Poultry	312 lb. @ 22¢	69	328 lb. @ 22¢	72
Eggs	172 doz. @ 35¢	60	184 doz. @ 35¢	64
Miscellaneous		51		51
Farm products used in home [c]		214		214
		$2,645		$2,807
Expenses:				
Fertilizer		$ 294		$ 297
Seed		47		73
Ginning	2 bales @ $4.50	9	7.6 bales @ $4.50	34
Picking peanuts	340 bags @ 20¢	68	200 bags @ 20¢	40
Peanut bags	340 bags @ 15¢	51	200 bags @ 15¢	30
Feed bought	4,960 lb. @ $3 cwt.	149	6,900 lb. @ $3 cwt.	207
Extra labor		80		... [d]
Real estate		72		72
Equipment		32		32
Taxes		128		128

TABLE 44—(*Continued*)

FINANCIAL STATEMENT FOR FARM "A" ORIGINAL AND FOR FARM "A" REORGANIZED[a]

		Original	*Reorganized*
Receipts:			
Auto expenses		60	60
Miscellaneous		32	32
Total		$1,022	$1,005
Farm income		1,623	1,802
		$2,645	$2,807
Net gain for reorganization			$179
Farm income		$1,623	$1,802
Less value unpaid family labor	$300		
Less operator's labor	500	800	800
		$ 823	$1,002
Per cent return on investment		5.8	7.7

[a] Standard prices used throughout.
[b] It is not advisable in the area to which this farm applies to produce milk for sale. There is, however, a limited market for butterfat. See standard 40-acre farm for recommendations.
[c] Does not include vegetables.
[d] Work on reorganized farm can be done without hiring extra labor.

A more serious criticism than that of artificiality is advanced relative to the theoretical aspects of the method. It has been said that in using normal labor and material requirements and normal prices, the marginal concept in the use of resources has been ignored or forgotten. (See Chapter V.) That is, the critics of the theoretical aspects of the method state, and correctly, that there is no such thing as normal or "necessary" material requirements for the production of a crop and livestock product. The requirements for production, except perhaps for basic minima, will vary with changing prices and costs, with the efficiency and capacity of the entrepreneur, and with a number of other conditions.

To quote Benedict:

> It is customary to speak of "labor requirements" and of "feed requirements" as though these were fixed and unchangeable, rather than rela-

> tive to the needs of other lines of production and to the prices of items of input and output. Yet the study of diminishing returns in given enterprises has demonstrated that these are not "requirements" but rather particular factor combinations that have been established by rule of thumb for the enterprise combinations previously existing on these farms; that the optimum inputs may be different for different price conditions, a point that has been little discussed for different combinations of enterprises. Thus the amounts and timing of labor inputs are judged largely by what they have been rather than on the basis of what might be an optimum relationship under a new set of conditions. There is, of course, a considerable element of flexibility in the farm labor situation which makes it possible for the farmer to adjust himself to errors of judgment which he may make in developing some new organization of the farm business, and he may change the so-called "requirements" to a better adjustment almost without being conscious of the fact that he is doing so.[8]

This criticism is beyond a doubt a valid one. A standard combination of enterprises is not designed, however, without some reference to the theory of diminishing returns and of equimarginal net returns. In devising the standards to be used, a number of combinations based on the organization of farms in a given area are set up, and financial results are determined. That combination of enterprises for a given set of resources which appears to be most profitable is accepted as a standard. Roughly, then, the factors of production, assuming normal requirements and prices, have been used to the best advantage or have been distributed to the various enterprises in such a manner as to obtain equimarginal net returns. It is true, nevertheless, that data are not available in the form required by the theory of equimarginal net returns, nor are such data likely to be available in the near future. In the absence of such information it is well for the student to keep in mind these limitations of the standard. If such a method be used in assisting farmers to reorganize their farms, it is also well to point out to farmers the necessity of using their experience and judgment in determining to what extent a standard combination of enterprises should be adopted and also the need for modifying the requirements for crop and livestock production, if conditions on a particular farm are quite different from those used in the standard.

---

[8] Benedict, M. R., "The Opportunity Cost Basis of the Substitution Method in Farm Management," *Journal of Farm Economics*, Vol. XIV, No. 4, pp. 542–543.

Questions

1. What are the advantages of having a standard farm set up for a given area? Upon what factors does the usefulness of this standard depend?

2. Why was cotton acreage reduced and corn acreage increased on the farm under adjustment?

3. Explain how or why it may be impossible to obtain perfection in labor utilization on a farm in North Carolina.

4. What is the relationship between livestock and crop enterprises? Illustrate.

5. The net income from the standard is higher than that from the farm to be adjusted—assuming equal size, yield, labor (potential), equipment, and so forth. To what may this added income be attributed?

6. State briefly the criticism of the standard method. Is this criticism valid?

References

Hopkins, John A., *Farm Records.* Ames: Collegiate Press, 1936, Chapter II.

Hutson, J. B., *Progress in Development of the Budget Method of Planning in Agricultural Economics.* Washington, D. C., 1930.

U. S. Department of Agriculture, *Farmers' Bulletin 1564,* "Farm Budgeting," by J. B. Hutson, 1928.

CHAPTER X

Specialized and Diversified Farming

IN MOST popular discussions, the problem of farm organization or the combination of enterprises is approached from the rather restricted point of view of *diversified* or *specialized* farming. As a rule, each of these has its advocates. No middle ground is tolerated, nor is there any widespread belief that both concepts may be correct, depending upon the conditions facing the individual farmer. It is the purpose of this chapter to consider diversification and specialization of production and to determine, as far as data are available, the true nature of the problem involved.

1. Diversification and Specialization Defined and Described

The term *diversified farming,* as popularly used, has no definite meaning. The common connotation is that a farm is diversified when its organization includes several crop and livestock enterprises. That is, the larger the number of enterprises, the more diversified the farm. Accurately stated, however, diversification is a function of two things: (a) the number of enterprises, and (b) the magnitude of the income derived from each enterprise. A farm business might consist of one principal enterprise together with a number of supplementary and complementary enterprises, but, unless these other enterprises are in themselves a source of income directly, the farm is said to be *specialized.* Complete specialization is seldom found in agriculture. Diversification is the rule rather than the exception. But diversification is a matter of degree, not of kind. At one end of the scale of the combination of farm enterprises is diversification, and, at the other, complete specialization. There are, then, not two problems but rather two aspects of the same problem, that of obtaining the most profitable combination of farm enterprises for a given set of resources available or under the control of the farm operator (see Chapters VI to IX).

It is convenient, however, to recognize four different degrees of diversification or specialization.[1]

a. When a farm is organized for the production of a single commodity, and this commodity is the only source of income, the farm is said to be *specialized.*

b. When a farm is organized for the purpose of turning out a single product as the chief source of income but has several complementary or supplementary enterprises that contribute *indirectly* to the farm income, the farm is said to be *semispecialized.*

c. When a farm is organized to produce several commodities each of which is in itself a direct source of income, the farm business is said to be *diversified.*

d. Finally, when a farm is organized to produce one main product, but has also several other enterprises which contribute *directly* to the farm income, the farm is said to be *semidiversified.*

2. The Law of Comparative Advantage

A discussion of the reasons for specialization and diversification necessitates some reference to the important principle of comparative advantage. It is the principle or law of comparative advantage which governs the farmer in his choice of enterprises. A general statement of the law is difficult because of the numerous factors, economic and physical, which are involved. (See Chapter IV.) However, the following will do as a brief statement of the law: *Each farmer will tend to produce those products for which his resources enjoy the greatest comparative advantage.*

---

[1] See Gray, *Introduction to Agricultural Economics*, p. 123.

It should not be understood that a given farm will be devoted exclusively to a single line of production, although this may be the case, but rather the farmer's resources will be used primarily in that line of production for which the area, and more particularly his farm, has a comparative advantage. Hence, in order to utilize more fully or completely his available resources, a farmer in a given area may find it advisable to add to his principal line other lines of production. These other lines of production will be chosen partly upon their complementary and supplementary characteristics and partly on the basis of their relative prices. In short, a farmer on a given farm will organize his resources so as to produce to the maximum that commodity for which the farm has a comparative advantage, and then, if there

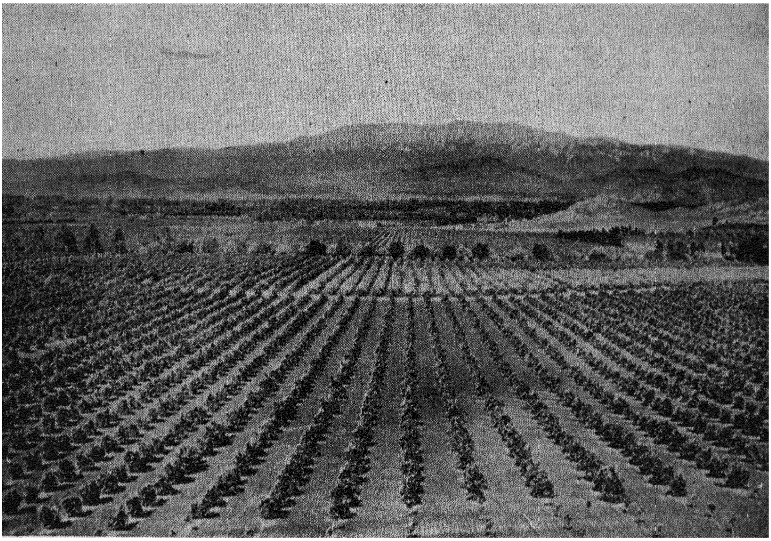


Illustration from Bu. of Agr. Econ.

Fig. 19. A peculiar combination of soil and climate is often necessary for a high degree of specialization. Orange groves in Santa Ana Valley, near Arlington Heights, California.

are any unused resources still available, these will be used on such other lines as will tend to increase the net profits of the farm.

3. Reasons for Specialization

The principle of comparative advantage, as already observed, governs the farmer in his choice of enterprises, but we can be somewhat more specific by giving definite reasons why farmers tend to specialize.

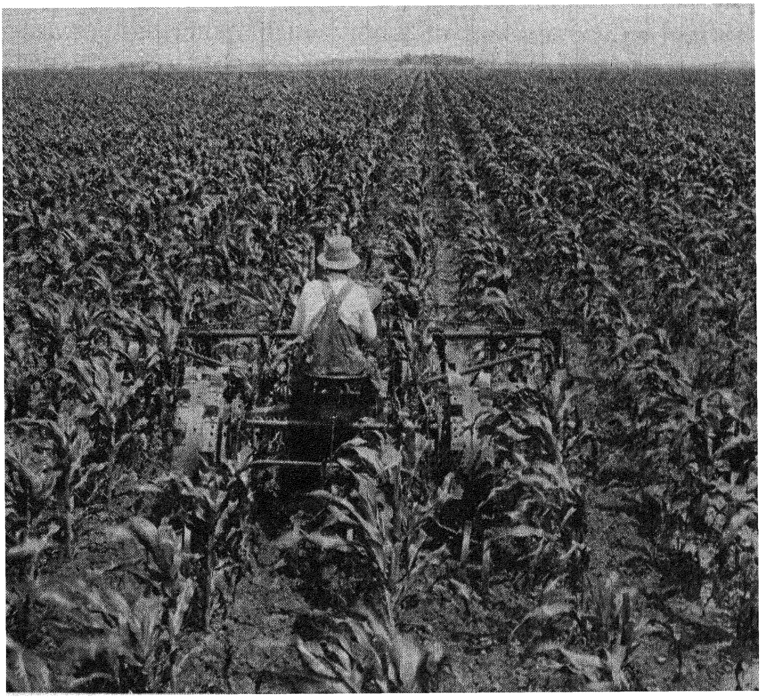
a. In a given area, because of the peculiar character of soil, topography, climate, and other physical conditions, one product may be more profitable than any other that can be grown. If this be the case, there will be a tendency for farmers to devote a large part, perhaps all, of their resources to one line of production. Cotton, because of climate, soil conditions, and labor supply, is one of the most profitable crops which can be grown in the Coastal Plain, although other crops can be and are grown in this area. But, because cotton is relatively best adapted to the existing conditions—that is, has a comparative advantage—it tends to force other products into secondary positions. Citrus fruit in Florida and California, corn in the Corn Belt, and wheat in Kansas and the Dakotas are other examples of products adapted to certain areas.

b. Specialization may be a means of enlarging the farm business. On large farms it is often possible to perfect better field arrangements, to equip the farm more adequately, and to establish, to some degree at least, a division of labor, specialization of tasks, or specialization in operation.

c. A system of farming based on a single enterprise is more easily reduced to routine than a system consisting of a number of enterprises. The reduction of the farm operations to routine permits the manager to acquire special skill and knowledge relative to the main enterprise.

d. Specialization may permit a farmer to give attention to methods of developing a market and of selling products.

When one product is turned out, a farmer may follow more closely the market conditions than when a number or variety of products are produced. The production of a special commodity may permit the development of a special trade, which will make the farm more profitable than will the production of several products. Moreover, when farmers devote their attention to the production of one commodity, it is easier to develop coöperative marketing than when several products are involved. A good illustration of this is to be found in coöperative marketing of citrus fruits in California and Florida, or raisins in California, and of dairy products in Wisconsin.



Courtesy of the International Harvester Co.

Fig. 20. Specialization in agricultural production is promoted by highly specialized machines.

e. The availability of some element of production may be a factor in specialization. Young men just beginning to farm often find it necessary to specialize to a greater extent than the farmer who has been in the business for some time. For example, such a young man may not possess sufficient capital to buy livestock; hence, he has to devote his time and attention to the production of crops. Later on, as he accumulates sufficient funds, he may find it advantageous to add livestock to his farm business. Sometimes the availability of labor may limit specialization. In some cases, such as in the growing of wheat, in the production of strawberries, and in the production of cotton, the acreage planted is limited to the amount of labor which is normally available at harvesting time. The larger the amount of available labor which can be obtained at reasonable rates at harvest time, other conditions being favorable, the greater the inducement to specialize.

f. The type of machinery available affects specialization. When hand tools were common, specialization could not be carried very far. However, when certain machines became available, specialization became common. With the invention and perfection of the reaping machine and combines, it became profitable to specialize in the production of wheat and small grains. With the invention and perfection of spraying machines, fruit growing became profitable. Further specialization in cotton production can be anticipated if a successful cotton picker and a chopping machine were to become generally available to farmers. If this should occur, complete mechanization of the production of cotton would then be possible.

g. Perfection of methods of manufacturing or of preserving products is a factor affecting specialization. The invention of machinery for condensing milk and for making milk powders tends to expand the market for these products. With the expansion of the market there is a tendency to specialize in dairying. Improved methods of handling beef and beef products also tend toward specialization in the production of livestock.

h. Changes in demands may bring about specialization. As a rule, consumptive demands are fairly well adjusted to what nature can be made to produce. However, sudden changes in demand may bring about specialization of production, or the reverse.

i. A change in tariff policy may be a factor affecting specialization. An increase in the tariff on goods which are normally produced in this country, but not in sufficient quantities to supply the domestic demand, will tend to bring about a higher degree of specialization. An increase in tariff on sugar, peanuts, and wool will tend, other things being equal, to make it more profitable to specialize in these things than if these products were on the free list.

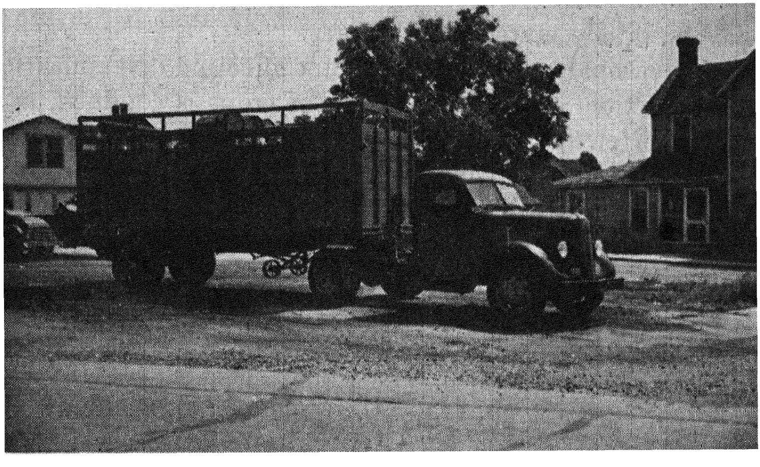


Illustration from Farm Credit Adm.

Fig. 21. Improvements in transportation when accompanied by lower transportation costs tend to encourage specialization in agricultural production.

j. Specialization sometimes provides more leisure than does diversification. When this is the case, farmers often engage in some other business; or other businessmen often engage in farming. Thus, in many of the sections of the South, lawyers, physicians, and merchants may engage in cotton production because it does not demand careful supervision throughout the year.

k. Specialization is encouraged by improved transportation facilities. When transportation facilities are poor, the farmer finds it more profitable or even necessary to diversify. Just as soon as market facilities are adequate, the tendency has been to concentrate on the production of some one product or a few products. Refrigerator cars, rapid freights, good roads, and the advent of the automobile have all been factors affecting specialization in agricultural production.

4. Reasons for Diversification

While there are many factors operating in favor of specialization, the fact remains that, generally speaking, farming is characterized not by specialization but by diversification. The factors favoring diversification in agriculture may be briefly stated as follows:

a. Seasonality is the chief factor affecting diversification of production. Since production of crops is confined, as a rule, to a few months of the year, farmers find it advisable to add livestock or poultry to the farm business in order to make a better utilization of their resources. This is especially true if they have no outside alternative for employing their labor and other resources. In some instances, however, the seasonality of farm work may be a factor bringing about specialization. For example, dairy cattle may be added to the farm business for the purpose of giving employment to farm labor during the winter, and dairy farming may be, and usually is, a highly specialized type of farming.

b. Diversification is often the means of reducing risks. In order to avoid loss due to variability in weather, farmers have resorted to diversification. The inclusion of several enterprises in the farm business is not always a means of reducing loss from weather conditions. Change in weather conditions may be as destructive to several crops as to one. This is especially true when the crops are advanced somewhat in growth. However, since crops may be planted and harvested at different times of the year, diversification in crop production does give some insurance against loss.

Changes in marketing conditions may also be the cause of loss. It may happen that prices of a given product may be so low as to be disastrous. Diversification as a means of reducing this type of risk is based on the assumption that all prices will not be low at the same time. It should be observed, however, that market prices often move together. Hence, diversification is not a complete method of insurance against loss due to changes in market prices. For example, in 1920 practically all farm products collapsed at the same time. As a rule, however, diversification does provide some protection against loss in changes of market prices.

Diversified farming may be a means of reducing damage from insect pests and plant diseases. The production of several crops in rotation may be a means of checking the damage which normally would result from these pests and diseases.

c. The utilization of intermediates and by-products is a factor affecting diversification. Farmers may find it profitable to introduce enterprises for the purpose of transforming by-products into marketable products. Again, in the case of intermediate products, such as corn, oats, wheat, rye, and barley, the farmer may have the choice of marketing these directly in their native form or of transforming them into some type of livestock product. When the prices of livestock products are high relative to prices of intermediate products, the farmer will find it profitable to convert these into livestock products. On the other hand, when the price of an intermediate product is high relative to the price of a livestock product, the tendency will be toward specialization.

Improvement in the technical skill and methods of conversion of by-products or intermediate products makes the conversion of these more profitable. Hence, there will be a tendency under such conditions to utilize products formerly sold directly on the market or allowed to go to waste.

d. The improvement or maintenance of soil fertility is often a factor working for greater diversification. The feeding of crops to livestock results in the producing of manure as a by-product. The manure may be applied to the land for the purpose of crop production. Under these conditions it may pay to produce a crop which would not be produced if the manure were not available. It should be pointed out that diversification is not absolutely essential for the maintenance of soil fertility. A highly specialized farming system, such as dairying, may maintain the fertility of the soil as well as a highly diversified farm. Again, a farm may be highly diversified, and still the fertility of the soil may not be improved or maintained. Farms producing several row crops, such as corn, are diversified, yet such diversification does not, of necessity, maintain or improve the fertility of the soil.

e. Diversification often gives a better distribution of money income throughout the year. When farming, with the possible exception of dairy farming, is highly specialized, the income is usually received during a short period. Diversification, however, may distribute the income more evenly throughout the year. This is often desirable. The concentration of the income in one season may lead to extravagance or may encourage it. On the other hand, there is a tendency to economize when the income is received in small amounts throughout the year.

f. Increase in transportation cost is a factor affecting diversification. An increase in freight rates tends to bring about diversification in farming. Freight rates may be so high on a given product that the farmer will be forced to abandon the production of it. For example, in many parts of the irrigated sections of the West, alfalfa is produced and shipped to eastern markets. However, an increase in freight rates may cause the production of alfalfa to become unprofitable and force farmers to resort to the production of other crops. Other things being equal, the higher the freight rates on those things in which the farmer is specializing, the greater will be the tendency toward diversification.

g. A change in demand may bring about diversification. If the demand for a principal or a main product increases relatively to other competing enterprises, the tendency, as already pointed out, is toward specialization. But, if the demand for the principal product decreases, the tendency is toward greater diversification, especially if there are other products which are competing strongly with the main product for a place in the production scheme.

5. Diversification and Returns

Farm returns are not necessarily a function of diversification or of specialization. Whether or not specialization will pay better than diversification depends on the combination of the various factors enumerated and discussed in this and preceding chapters. In general, it may be said that in any given region, when the conditions favor diversification, it will not pay, except occasionally, to specialize. On the other hand, if the conditions are all, or almost all, favorable to specialization, it will not pay to diversify. A general principle or statement cannot be made which will hold for all conditions. Or, to state it in more definite terms, returns will not increase or decrease necessarily as the degree of diversification increases or decreases. A few examples will be presented to illustrate this fact.

According to a study made in 1925, specialization paid better than diversification in Appomattox and Pittsylvania counties, Virginia. This fact is shown in Table 45. As the area in tobacco increased, when other factors were held constant, the operator's earnings increased.[2] However, this does not mean that it will pay to produce tobacco exclusive of all other farm crops. Table 46 shows the influence of

---

[2] Data were analyzed by partial and multiple correlation methods.

TABLE 45

RELATION OF THE ACRES IN TOBACCO TO OPERATORS' EARNINGS[a]
(WITH EFFECTS OF OTHER FACTORS ELIMINATED)

Area in Tobacco (*Acres*)	*Average Operator's Earnings*	
	Appomattox County (*Dollars*)	*Pittsylvania County* (*Dollars*)
None	300	725
1 to 3	340	740
3 to 5	435	750
5 to 7	565	800
7 to 9	700	950
9 to 11	855	1,110
11 to 13	955	1,350
13 to 15	1,105	1,560
15 to 17	1,215	1,640
17 to 19	1,405	1,760
19 to 21	1,540	1,850
21 to 23	......	......
23 to 25	......	2,060
25 to 27	......	2,140
27 to 29	......	2,175
29 to 31	......	......
31 and over	......	2,210

[a] Virginia Agriculture Experiment Station, *Bulletin 241*.

TABLE 46

RELATION OF THE VALUE OF PRODUCTS PER PLOW ACRE NOT IN TOBACCO TO OPERATORS' EARNINGS[a]
(WITH EFFECTS OF OTHER FACTORS ELIMINATED)

Value of Other Products per Acre (*Dollars*)	*Average Operator's Earnings*	
	Appomattox County (*Dollars*)	*Pittsylvania County* (*Dollars*)
0- 4	455	......
5- 9	540	1,080
10-14	670	1,210
15-19	730	1,300
20-24	785	1,300
25-29	840	1,205
30-34	900	1,320
35-39	940	1,480
40-44	935	1,420
45-49	910	......
50-54	890	......

[a] Virginia Agriculture Experiment Station, *Bulletin 241*.

supplementary enterprises on operator's earnings when other factors, such as the size of farm and the area in tobacco, are held constant. From this table it is evident that the value of supplementary crops per acre, up to a certain point, increased the operator's earnings. In Appomattox and Pittsylvania counties the earnings increased up to the point at which the supplementary crops were worth from $35 to $40 per acre; or on farms having this income from supplementary crops, an operator's income was $400 more than it was on farms which had from $5 to $10 per acre. This means that, although it pays to specialize in tobacco production, the largest returns are obtained when supplementary enterprises are added to the farm business.

A study of 357 farms in Chester County, Pennsylvania, shows that of twelve factors affecting the operator's earnings the receipts from the dairy herd were by far the most important. These twelve factors accounted for 71 per cent of the operator's earnings, of which 57 per cent was attributable to receipts from the dairy herd. In Chester County, as in the case of tobacco farming in Virginia, complete specialization was not practiced. (Table 47.) A combination of mushrooms and dairy enterprises with other supplementary enterprises gave the largest operator's earnings. Dairy farms were more profitable than were crop farms. In general, for the majority of farms, the highest profits were obtained by a combination of dairy, poultry, and cash crop enterprises. In this case diversification became more profitable as the size of the farm increased.

Diversification apparently was the most profitable type of farm organization in Highland County, Ohio. (See Table 48.) A study of 80 farms in this area shows that those farms which had incomes from five or more sources (indicating a considerable degree of diversification) were most profitable. The average labor income on farms which had five main sources of receipts was $1,032, as compared with $112 for farms which had one main source of income. The data presented in Table 48 should not be taken as conclusive

TABLE 47

FINANCIAL RESULTS FOR DAIRY AND MUSHROOM-DAIRY FARMS OF THE SAME SIZE [a]

Item	*Farms 46 to 60 Crop Acres*		*Farms 61 to 75 Crop Acres*	
	Dairy	*Mush-room-Dairy*	*Dairy*	*Mush-room-Dairy*
Products sold	$3,195	$4,949	$3,586	$10,628
Farm products used by family	277	286	252	340
Gains in inventory	75	207	192	178
Total value of products	$3,547	$5,442	$4,030	$11,146
Charges against product:				
Cash expenses, except land and interest	$1,726	$3,273	$2,121	$4,780
Value of family labor	328	440	213	421
Charge for use of real estate and capital	524	566	649	931
Total charges	$2,578	$4,279	$2,983	$6,132
Operator's earnings	$969	$1,163	$1,047	$5,014

[a] U. S. Department of Agriculture, *Bulletin No. 1400.*

TABLE 48

THE RELATION OF DIVERSIFICATION TO LABOR INCOME [a]

Number of Sources of Income	*Average Labor Income*	*Number of Farms*
5	1,032	10
4	894	23
3	616	18
2	254	17
1	112	12

---

[a] ***Ohio Extension Bulletin No. 3,*** Vol. XIII.

proof that specialization would be unprofitable in this section. It is probably true, however, that diversification pays better than specialization.

In Sumter County, Georgia, specialization in cotton production apparently paid better than diversification. Both in 1913 and in 1918 farms with a high percentage of crop acres in cotton paid better than farms with low percentage in cotton. (Table 49.) In this case, as in most cases, a complete specialization was not practiced. In most cotton sections, it probably pays to produce all of the feed needed for livestock and a considerable part of the products consumed by the farm family.

TABLE 49

Comparison of Farms with Low and High Percentage of Crop Area in Cotton (White-Owner Farms, Sumter County, Georgia)[a]

	1913			*1918*		
	Per Cent of Crop Area in Cotton			*Per Cent of Crop Area in Cotton*		
	50 and Under	*51 to 60*	*Over 60*	*30 and Under*	*31 to 40*	*Over 40*
Number of farms	75	69	54	67	71	69
Acres per farm	243	229	405	277	286	277
Crop acres per farm	112	143	249	137	158	167
Per cent of crop area:						
In cotton	41	56	67	23	34	48
Used for legumes	17	17	12	58	49	36
Used for second crops	8	9	6	12	11	9
Used for interplanted crops	7	7	6	34	33	23
Yield of cotton per acre — pounds of lint	295	260	288	255	264	257
Per cent of receipts from:						
Cotton	71	84	90	60	76	82
Corn	5	4	2	6	6	4
Peanuts	....	....	....	8	4	1
Hogs	6	1	1	14	6	5
Per cent of farms with enterprises other than cotton each returning 10% or more of farm receipts	37	12	1	79	48	23
Average number of enterprises other than cotton returning 10% or more of the farm receipts	.5	.1	.1	1.1	.6	.2
Capital per farm	$9,916	$11,813	$20,953	$16,559	$20,260	$21,631
Value of real estate per acre	33	42	42	47	57	63
Farm income	914	1,134	2,704	1,824	2,683	3,726
Labor income	220	307	1,237	665	1,265	2,212
Operator's labor	443	383	550	555	625	598
Per cent return on capital	4.8	6.4	10.3	7.7	10.2	14.5
Family living from the farm	....	....	....	723	725	672

Farms similar in crop area and yield of lint cotton with low and high percentages of the crop area in cotton.[b]	*1913*		*1918*	
	Select Farms with		*Select Farms with*	
	Low per Cent of Crop Area in Cotton	*High per Cent of Crop Area in Cotton*	*Low per Cent of Crop Area in Cotton*	*High per Cent of Crop Area in Cotton*
Number of farms	30	30	30	30
Crop acres per farm	144	155	170	163
Yield of cotton — pounds of lint	257	254	244	259
Per cent of crop area in cotton	41	65	27	47
Labor income	$186	$619	$722	$2,125
Per cent return on capital	4.7	9.2	7.3	14.4

---

[a] U. S. Department of Agriculture, *Bulletin No. 1034*, p. 47.

[b] To eliminate effects of size and yield in comparing farms with low and high percentages of crop area in cotton, 30 pairs of farms were selected each year. One farm in each pair had a low percentage of crop area in cotton, the other a high percentage. Each had practically the same crop acreage and the same yield of cotton per acre

Questions

1. Explain how the law of comparative advantage works in agriculture.
2. What is diversification? What do we mean by diversified farming?
3. What are the degrees of diversification?
4. Why does the modern farmer specialize?
5. Give the specific advantage of diversification.
6. Is diversification or specialization more profitable (a) in Pennsylvania? (b) in Georgia? How do you account for this?

References

Adams, R. L., *Farm Management.* New York: McGraw-Hill, 1921, Chapter V.

Black, J. D., *Production Economics.* New York: Henry Holt, 1926, Chapter VIII.

Boss, Andrew, *Farm Management.* New York: Lyons and Carnahan, 1923, Chapter IV.

Brinkman, Theodore, *Economics of the Farm Business.* Berkeley: University of California Press, 1925, Chapter III.

Gray, L. C., *Introduction to Agricultural Economics.* New York: Macmillan, 1932, Chapter XVII.

Holmes, C. L., *Economics of Farm Organization and Management.* Boston: Heath, 1928, Chapter III.

Hopkins, John A., *Elements of Farm Management.* New York: Prentice-Hall, 1936, Chapter III.

Warren, G. F., *Farm Management.* New York: Macmillan, 1916, Chapter III.

CHAPTER XI

Units of Measurement

BEFORE one farm can be compared to another with respect to size, productivity, quantity of livestock, and labor available, these things must be reduced to a common base. This is accomplished by using a definite measure for each factor which is to be compared. The nature of the measurements that are used and that are generally accepted by agricultural economists is the subject of this chapter. It should be emphasized that these measures are imperfect and, at best, can be considered as only roughly accurate.

1. Measuring the Size of the Business[1]

One of the first problems that confronts the investigator when he is comparing one farm with another is that of measuring the size of the business. It would be illogical, for example, to compare the net income of an 80-acre farm with that of a 160-acre farm, and to conclude that because the 160-acre farm has a larger income it is, therefore, better organized and better operated. Comparisons of this character should be made as far as possible between farms of the same size, or approximately so. Assuming that only farms of the same size should be compared, the problem immediately arises as to what measure of size to employ.

Just what is meant when one farm is said to be larger than another? The usual answer to a question of this sort is that one farm is larger than another farm when the area of one is greater than that of the other. This answer is correct, if the distribution of the farm area to crop land, pasture land, waste land, woodland, and idle land and the systems of farming are the same on the farms compared. But it is incorrect if the distribution of the land area is different on the two farms. Suppose, for example, that two farms are equal in size when total area is used as a measure of size, but that on examination it is found that one of these farms has 90 per cent and the other only 50 per cent of its total area in crops. Obviously, these two farms are not at all comparable.

---

[1] Black, J. D., *Production Economics*, pp. 538–542.

There may be conditions under which the area in crops is a much better measure of the relative size of the two farms than the total area. This is based on the assumption that the net income of farms is more likely to be affected by the area in crops than by any other factor. But this measure is likely to be inaccurate, especially if the farms being compared are cultivated with different degrees of intensity, which is likely to be the case if the crop area is devoted to different types of crops. For example, two farms having the same crop area and each producing cotton, tobacco, corn, and soybeans will not be comparable if on one of the farms 90 per cent of the area is devoted to cotton and on the other only 10 per cent is so used.

Another way of measuring the size of farms is to use the volume of physical output. The underlying assumption in this case is that the physical output is the resultant of all of the factors, whatever they may be, used in production. But this method is not always usable, as the variation in output may be the result of things that are not under the control of the management. For example, variation in output may be caused by weather conditions, which may not affect equally all of the farms being compared. Furthermore, output is more particularly a measure of capacity and does not reflect necessarily the efficiency with which the factors of production have been employed. The output of a given farm may be increased by liberal and perhaps inefficient use of some or all of the factors of production. Hence, a large output may be correlated negatively with such measures of success as net income. Or, to state this problem somewhat more specifically, farms are operated with different degrees of efficiency as well as with different degrees of capacity. This being the case, the physical output is not, or may not be, an accurate measure of the size of the farm.

The normal market value of a farm may be used as a measure of size. The farm having the greater value might be said to be larger than the farm having the lesser value. This measure has some merit in that it assumes that both capacity and efficiency are reflected in the normal value of the property, inasmuch as value is largely determined by the net income, which in turn is the result of both the size of the farm and the efficiency with which it is operated. But one of the two farms being compared on this basis may be located much nearer to a large and prosperous town than the other. Obviously in this case, other things being equal, and irrespective of the way in which the two farms may be operated, the farm which is nearest to town will have a higher market value than the one which is not so favorably located. Then, there is the problem of obtaining accurate market values, and the additional question of what value shall be used where the market value is not readily obtainable. The assessed value has been suggested, but this measure is not usually arrived at in a scientific manner but normally is based upon the judgment of relatively few individuals.

The price originally paid for the farm has been suggested also, but this measure must be ruled out because the farms being compared may have been purchased at widely different times and may not reflect the current value of the property. But, even assuming that a fairly satisfactory measure of value could be obtained, the measure is still open to criticism in that the farms being compared will doubtless be using different kinds and amounts of farm machinery, tools, and the like. These instruments of production must be valued in some uniform manner in computing the total value of the farm, if total value is to be used as a basis in comparing one farm with another. Likewise, the livestock must be valued in some accurate manner. To evaluate property, tools, machinery, and livestock is no easy task, and, hence, errors of a considerable magnitude may be made.

It is not necessary for the purpose of this discussion to elaborate the difficulties of obtaining an adequate measure of the size of the farm. It is generally agreed among agricultural economists that there is no such thing as one accurate measure of the size of the farm. That is, there is no one measure which will meet all of the tests of accuracy. Students of the problem suggest, therefore, that in comparing the size of one farm with that of another, that measure, whatever it may be, should be used which appears to give the most satisfactory results. In some instances this may be the total area in the farm, the crop acres, the physical output, or the total value. That is to say, in any attempt to associate size of business as a causal factor affecting the success of a farm, any one of these measures may be used. But, it should be emphasized that care must be used in selecting and in determining the measure. Too much confidence should not be placed in any one of a number of such measures.

2. Measuring the Factors of Production

The discussion in Section 1 raises certain questions as to the adequacy of the various measures of size of business. In using these measures it is necessary to develop ways and means of measuring the various factors involved, such as land, buildings, machinery, and workstock. For example, how should productive area, livestock, labor, and the like be determined and expressed? It is the purpose of this section to consider this question.

a. *Measures of productive area.* In measuring productive area, as pointed out earlier, the comparison of total acreage may be misleading. Two farms may contain land of such a different character that it will be difficult to say just which one contains the more actual productive area. For instance, one may contain a greater percentage than another of meadow land or pasture, both of which may be available for crops. Of course, if the actual land in crops is all that is being compared, the crop area will serve the purpose; but if pasture land in the farm is to be considered, some other method must be used.

One way of doing this is to reduce the pasture land to an expression known as the *"crop area equivalent."* [2] This method involves determining the amount of pasture land required to maintain an animal unit for a given period of time, e.g., six months. Then this amount of pasture land is considered the equivalent of the amount of crop land required to grow enough hay to support a mature horse or cow for the same period. This method may be illustrated in the following manner: There are two farms of equal area which may be designated Farm "A" and Farm "B". Farm "A" has 100 acres in crop land and 50 acres in pasture; and Farm "B", 50 acres in crops and 100 acres in pasture. The problem is to reduce these farms to a comparable basis. Two things must be known, (1) the carrying capacity of the pastures and (2) the power of the land on each farm to produce hay. Suppose that the carrying capacity of the pasture land on Farm "A" is one mature animal to each 5 acres; that of Farm "B", one mature animal to each 3 acres. Suppose also that the productive power of the hay land on Farm "A" is 1.5 tons per acre and that on Farm "B", 2.0 tons per acre. Suppose further that 26 pounds of hay, together with concentrates, are required per day for each mature animal; then each mature animal will consume in six months 4,740 pounds, or 2.37 tons, of hay. In the case of Farm "A", 5 acres will maintain one mature animal six months, and the hay land will produce 1.5 tons of hay per acre. The number of acres of hay land required to produce 2.37 tons of hay is 2.37/1.5 or 1.58. This means that 5 acres of pasture are equal to 1.58 acres of hay land, or 1 acre of pasture is equal to .316 of an acre of hay land. Similarly, in the case of Farm "B" the number of acres of hay land required to produce 2.37 tons of hay is 2.37/2, or 1.185; that is, 1.185 acres of hay land are equal to 3 acres of pasture land, or 1 acre of pasture is equal to .395 of an acre of hay land.

---

[2] *Farm Management Circular 1,* Jan. 7, 1926.

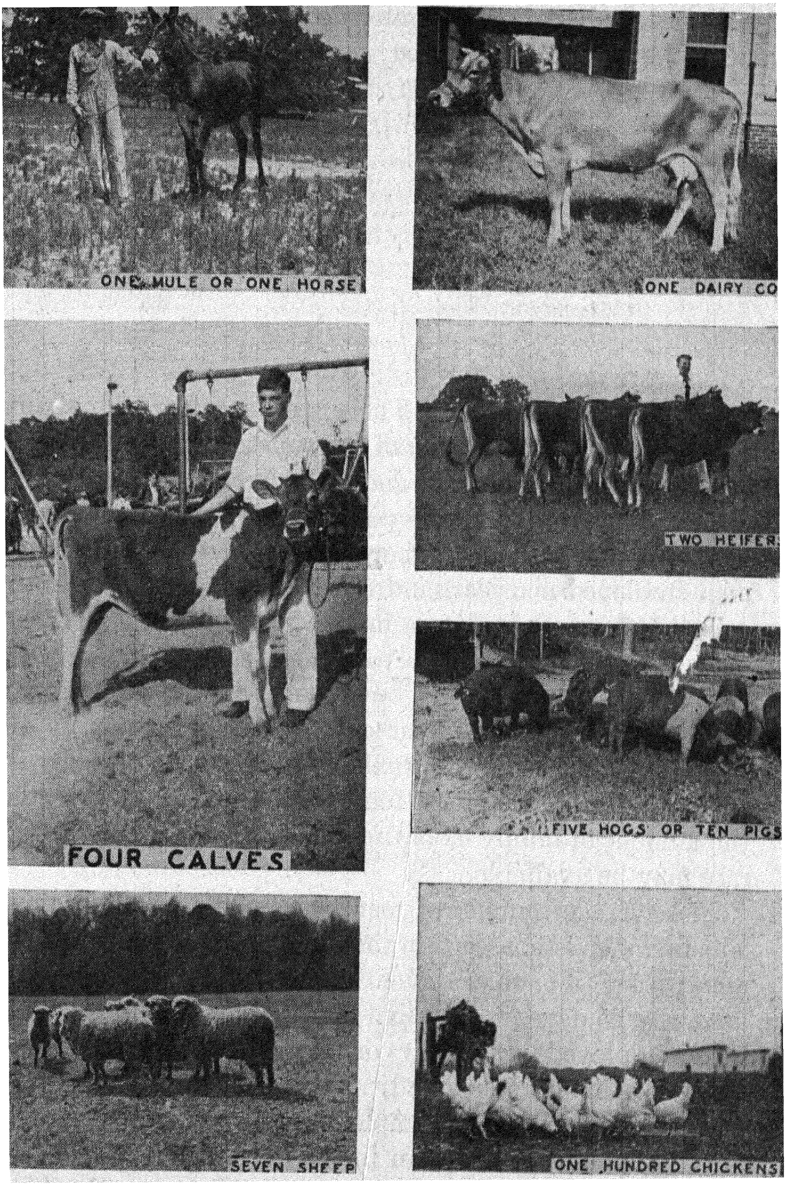
From these figures it is a simple matter to reduce each farm to the same basis. The 50 acres of pasture in Farm "A" are equal to (50 × .316), 15.80 acres of hay land. Or the comparable area of Farm "A" is (100 + 15.80), 115.8 acres; and for Farm "B" (50 + 39.5), or 89.5 acres. Instead of these two farms being of equal size, they are, in fact, unequal. The data are summarized in the following tabulation:

Farm	*1* *Crop Land*	*2* *Pasture Land*	*3* *Ratio of Hay to Pasture Land*	*4* *Pasture in Terms of Crop Land* (2 x 3)	*5* *Crop Land Equivalent* (1 + 4)
A............	100	50	.316	15.8	115.8
B............	50	100	.395	39.5	89.5

b. *Measures of livestock.* To find whether or not one farm is more heavily stocked than another, it is evident that the total number of all livestock cannot be used unless they are all of a uniform class. As this is seldom the case, each class must be converted to some comparable basis. The animal *"unit"* serves this purpose satisfactorily. This is simply a method by which the different kinds of animals are converted into "animal units" on a basis of the relative amounts of feed consumed by different classes of livestock. The following are advanced as being roughly the equivalent of an animal unit: one steer, one cow, one horse, or one mule; two heifers or two colts; four calves less than twelve months old; seven sheep; fourteen lambs; three sows, five mature hogs, ten pigs of 100 pounds; one hundred hens.[3] If a farm is

---

[3] Warren, *Farm Management,* p. 210.



Courtesy of N. C. Agr. Exp. Sta.

Fig. 22. The number of different classes of livestock which are equivalent to one animal unit.

stocked with two mules, three dairy cows, one calf, two heifers, ten sheep, seven lambs, three hogs, and seventy-five hens, the animal unit will be:

Class of Livestock	*Animal Units*
Two mules	2.00
Three dairy cows	3.00
One calf	.25
Two heifers	1.00
Ten sheep	1.43
Seven lambs	.50
Three hogs	.60
Seventy-five hens	.75
Total	9.53

c. *Measures of labor.* There are a number of measures for comparing the amount of labor used on farms. Those which are most important and most likely to give the best results are (1) total wages paid during the year, including value of unpaid family labor, (2) the average number of men employed per year, and (3) the productive work unit.

The first measure gives a unit in terms of value of wages paid and is comparatively easy to calculate, but entirely erroneous conclusions may be drawn if the wage rates paid on the farms being compared are not approximately the same. The measure is quite likely to be affected also by the wide variations which are found on farms with respect to the amount of family labor used for which no accurate wage rate may be available.

The average number of men per year is easily obtained. The first step is to ascertain the number of months that each man works. For this, a given number of days per month is used, say 25 days for all hired day labor and 30 days for all labor employed seasonally or annually. After the total number of months is found, it is divided by 12 to get the average number of men employed. To illustrate, suppose Farm A employed one man for 75 days at day wages, two regular hired men for 360 days each, and one regular hired laborer for 180 days. In the first case the number is (75/25), 3 months, the second is (720/30), 24 months, and in the third is (180/30), 6 months, making a total of 33 months. The average number of men employed for the year, therefore, is (33/12), or 2.75.

A productive work unit[4] is usually considered as an ordinary day's work for one man or horse. It represents the average or normal time required to care for each crop or class of livestock. For example, one unit of man labor and one unit of horse labor (work) are required to grow and cut once an acre of timothy hay. Two units of man work are required normally to grow one acre of small grain such as oats, wheat, barley, and rye; 12 units, for cotton; 35, for flue-cured tobacco; and 22 units are required to care for a dairy cow. More precisely, a work unit is equivalent to the amount of work done in ten hours.

A concrete illustration may make the concept of productive work unit clear. Suppose there are two farms, "A" and "B", and it is desired to know the work normally required on each when the crop and livestock combination and the number of work units normally required for each crop and class of livestock are known. From this information it is a simple task to determine the total productive work units. To do this, each crop or class of livestock is multiplied by its respective number of productive work units. For example, in the case of Farm "A" in the following tabulation, the

CROP AND LIVESTOCK COMBINATION

Enterprise		*Farm A*	*Farm B*
Corn	Acres	40	20
Cotton	"	10	10
Tobacco	"	5	3
Soybean hay	"	5	3
Oat hay	"	5	3
Dairy cows	Number	4	10
Dairy heifers	"	2	4
Brood sows	"	10	20
Other hogs	"	60	120
Hens	"	100	200

---

[4] Sometimes considered as a measure of efficiency of labor.

PRODUCTIVE WORK UNITS

Enterprise	*Productive Work Units* *Man*	 *Horse*
1 Acre of corn	4.5	5
1 Acre of cotton	12.0	5
1 Acre of tobacco (flue-cured)	35.0	7
1 Acre of soybean hay	2.0	2
1 Acre of oat hay	2.0	2
1 Dairy cow	22.0	3
1 Dairy heifer	5.0	1
10 Brood sows and raising pigs to weaning	30.0	1
10 Hogs not brood sows	5.0	1
100 Hens	30.0	1

40 acres of corn is multiplied by 4.5, the number of productive work units normally required to produce one acre of corn. This multiplication gives a total of 180 work units required to produce 40 acres of corn. In this manner, the total productive work units required for the other crops and classes of livestock have been calculated for Farm "A" and Farm "B," and the results are shown in the following tabulation.

The work required on Farm "A" is, according to this

Enterprise	*Farm A*		*Farm B*	
	Man Work Units	*Horse Work Units*	*Man Work Units*	*Horse Work Units*
Corn	180	200	90	100
Cotton	120	50	120	50
Tobacco	175	35	105	21
Soybean hay	10	10	6	6
Oat hay	10	10	6	6
Dairy cows	88	12	220	30
Dairy heifers	10	2	20	4
Brood sows	30	1	60	2
Hogs	30	6	60	12
Hens	30	1	60	2
Total	683	327	747	233

method of computation, 683 man work units and 327 horse work units, and that for Farm "B", 747 man work units and 233 horse work units. If these two farms employed on the average the same number of men and horses throughout the year, then it may be said that Farm "B" is using its man labor more effectively than Farm "A", but that Farm "A" is using its horse labor more effectively than Farm "B". The reason for this is clear since Farm "B" normally requires more man labor but less horse labor than Farm "A."

d. *Measure of machine capacity.* It is also possible to measure the capacity of farm machines. In some instances the capacity of a machine is stated by the manufacturer in output per hour. This is especially true of such machines as threshers, peanut pickers, and feed grinders. The capacity of other types of machines, such as tractors, engines, motors, is expressed in the horse power developed. The case is quite different, however, with such implements as plows, harrows, cultivators, rollers, hayrakes, and tedders. The capacity of these implements will depend upon their width (coverage) and the rate at which they are moving. Their capacity is, therefore, directly proportional to their width and speed. For example, a plow turning a 12-inch furrow would have a greater capacity when drawn by a tractor than when drawn by horses. The capacity of machines of this sort may be determined by the following formula:[5]

$C = \frac{SW}{8.25}$ when C = uninterrupted capacity in acres covered per hour, S = rate or speed of travel in miles per hour, and W = width of the machine in feet. Suppose, for example, that the rate of speed is 5 miles per hour and the width is 7 feet; then the uninterrupted capacity would be—

$$C = \frac{5 \times 7}{8.25} = \frac{35}{8.25} = 4.24 \text{ acres per hour}$$

---

[5] Davidson, Jay Brownlee, *Agricultural Machinery,* John Wiley & Sons, Inc., 1931, pp. 371, 372.

Daily Duty of Machines of Specified Kinds and Sizes[a]

Operation	*Kind and size of implement*[1]	*Power used*[2]	*Average acres covered per 10-hr. day*
Plowing	Moldboard, walking, 8-inch	1 horse	1.0
	Moldboard, walking, 14-inch	2 horses	2.0
	Moldboard, 2-bottom, 14-inch	5 horses	4.0
	Moldboard, 2-bottom, 14-inch	15 h.p. tractor	8.0
	Disk plow, 50-inch	20 h.p. tractor	13.0
	Disk plow, 10-foot, vertical, one way	20 h.p. tractor	28.0
Disking	Single disk, 8-foot, once over	4 horses	15.0
	Single disk, 20-foot, once over	20 h.p. tractor	60.0
Harrowing	Spike-tooth, 10-foot, once over	2 horses	15.0
	Spike-tooth, 20-foot, once over	4 horses	30.0
	Spike-tooth, 24-foot, once over	15 h.p. tractor	70.0
	Spike-tooth, 32-foot, once over	20 h.p. tractor	90.0
Cultivating–Corn or cotton	½-row, walking (2 times to row)	1 horse	2.5
	1-row, riding (1 time to row)	2 horses	7.0
	2-row, riding (1 time to 2 rows)	3 horses	12.0
	2-row, riding (1 time to 2 rows)	15 h.p. tractor	20.0
	4-row, riding (1 time to 4 rows)	15 h.p. tractor	35.0
Cutting corn	Binder, 1-row (corn not shocked)	3 horses	6.5
	By hand (corn shocked)	Hand	1.2
Picking corn	Mechanical picker, 1-row	15 h.p. tractor	7.0
	Mechanical picker, 2-row	20 h.p. tractor	12.0
	By hand	Hand	1.5
Mowing hay	Mower, 5-foot	2 horses	8.0
	Mower, 7-foot	15 h.p. tractor	20.0
Drilling grain	Disk drill, 7-foot	3 horses	12.0
	Disk drill, 10-foot	6 horses	18.0
	Disk drill, 10-foot	20 h.p. tractor	25.0
	Disk drill, 20-foot	20 h.p. tractor	50.0
Harvesting grain	Binder, 6-foot	3 horses	9.0
	Binder, 8-foot	4 horses	14.0
	Binder, 8-foot	15 h.p. tractor	20.0
	Combine, 5-foot	15 h.p. tractor	11.0
	Combine, 10-foot	20 h.p. tractor	22.0
	Combine, 16-foot	20 h.p. tractor	30.0
			Minutes per cow
Milking cows[3]	Milking machines, 2-unit (one milking)	Electric motor	5
	Milking by hand (one milking)	Hand	9

---

[a] *Managing a Farm*, United States Armed Forces Institute, Madison, Wisconsin, p. 146.

[1] Size represents working width.

[2] For modern tractors equipped with rubber tires.

[3] Minutes per cow include time for caring for machine and milking utensils.

This formula may be modified so as to allow for time lost in turning or for other reasons. Suppose P = the per cent time lost, H = the length of the working day, and A = actual capacity of the machine per day. The formula used is—

$$A = \frac{SWH\,(100 - P)}{8.25 \times 100}$$

An example will show how this formula is used. Let it be supposed that the length of the day is 10 hours and that the time lost is 17.5 per cent then:

$$A = \frac{SW \times 10 \times (100 - 17.5)}{8.25 \times 100} = \frac{SW\,825}{825} = SW$$

or A is equal to the speed of the machine times the width of the implement used. Using the former figure of $S = 5$ miles per hour and $W = 7$ feet, then $5 \times 7 = 35$ acres per day as the actual working capacity of the machine. Assuming 9.25 per cent loss of time due to delays, A would be equal to 38.5 acres per 10-hour day, or

$$A = \frac{5 \times 7 \times 10 \times (100 - 9.25)}{8.25 \times 100} = \frac{3812.50}{825} = 38.5$$ [6]

3. Measuring Diversification

The success or failure of a farm is sometimes attributed to the degree of diversification. Or, other things being the same, the success of a farm may be directly or perhaps inversely proportionate to the degree of diversification. Diversification is, however, a term which, when used in the ordinary sense, has no precise meaning. As commonly used, diversification refers to the number of enterprises only. That is, a farm is said to be diversified when there are a number of enterprises and to be specialized when there are only a few enterprises in the farm business. But this idea is defective. A more exact definition is needed. For an adequate concept of diversification not only the number of enterprises but also the income from each should be considered. For example, suppose there are two farms, each of which has two enterprises. According to the ordinary usage these farms would be equally diversified. But suppose that on one farm one of the enterprises contributes 75 per cent of the income, and on the other each enterprise contributes the same amount. Then the latter farm is certainly more diversified than the former.

---

[6] *Ibid.*

There are several ways of measuring diversification. If one is simply comparing two farms in regard to the livestock or to the crops grown, then the percentage of receipts from crops or livestock will constitute a fairly accurate measure. Another measure that is often helpful is the number of enterprises which produce more than 10 per cent of the total receipts. The larger the number of enterprises contributing as much as 10 per cent, the greater the degree of diversity. The total income derived from a single source is also a convenient measure of specialization. If over half the total crop receipts come from one enterprise, the farm is said to be specialized. If the degree of diversity is being measured on a farm where there is no difference in the importance of each enterprise, simply the number of enterprises will serve as a measure.

When mathematical accuracy is required, the "diversity index" should be employed. This index is obtained by squaring the fraction that receipts from each enterprise represent of total receipts and by dividing the sum of these squares into one. If there is a total lack of diversity, the result will be unity. Thus the diversification of a farm may be measured by the amount by which the diversity index exceeds unity. The tabulation on page 181 illustrates how the diversity index is calculated.

4. Measuring Productiveness

A measure of productiveness is often useful in comparing the relative output per acre of different farms that are in the same neighborhood. When only single crops are being con-

Enterprise	*Receipts*	*Fraction of Total Receipts*	*Square of the Fraction of Total Receipts*
Cotton	$2,400	.282	.079524
Tobacco	5,000	.589	.346921
Corn	100	.011	.000121
Hogs	350	.041	.001681
Poultry	150	.018	.000324
Dairy products	500	.059	.003481
Totals	$8,500	1.000	.432052

$$\frac{1}{.432052} = 2.314 = \text{Diversity index.}$$

sidered, the "single crop index" may be used. This is calculated by dividing the production per acre of the crop by the five-year average yield per acre (or by some other base) for the state or region, and by multiplying the quotient by one hundred. For example, suppose that the average cotton yield on a given farm is 500 pounds of lint per acre and that the average for the state is 250 pounds, the single crop index will be (500 × 100)/250, or 200.

Usually of much more importance is an index of total productiveness, and for such cases the "composite crop index" should be employed. This index may be obtained by dividing the total yield of each crop by the five-year average yield per acre for the state or region (or by some other base), adding the quotients and dividing the sum by the total acres in crops on the farm. Thus, if on 100 acres of cropland there were produced 2,000 bushels of corn, 1,000 bushels of wheat, and 500 bushels of oats, and with base yields per acre of 40 bushels of corn, 20 bushels of wheat, and 25 bushels of oats, the following calculations will have to be made to obtain the composite index of yields for this farm:

Crop	Acres	Production Bushels		Base Yield Bu. per Acre		Quotient[a]
Corn	50	2,000	÷	40	=	50
Wheat	25	1,000	÷	20	=	50
Oats	25	500	÷	25	=	20
	100					120

[a] Acres required to produce the production at base yields, e.g., 2,000 bushels of corn divided by 40 = 50 acres.

The production on a given farm is divided by the base yields, and the quotients added, which in this case is 120 acres. This means that at the base yield it will require 120 acres to produce the quantity of production that is produced on the given farm of 100 acres. The composite index of yields, therefore, is 120/100 × 100 = 120. Or, the total yields on this farm are 20 per cent above the base or average farm.

The method suggested above has been criticized by E. J. Working, who demonstrates that such an index often gives biased results. After experimenting with several indices, Working suggests a weighted index[7] calculated as follows:

	1	*2*	*3*	*4*	*5*	*6*	*7*
	Yield per Acre					*Value*	
Crop	*Actual Farm*	*Base*	*Base Acres*	*Price per Bu. (Cents)*	*Weights (3×4) (Dollars)*	*Base Yields (2×5) (Dollars)*	*Actual Farm (1×5) (Dollars)*
Corn ..	40	40	70	80	$56	$2,240	$2,240
Wheat ..	40	20	20	85	17	340	680
Oats .	20	25	35	40	14	350	280
						2,930	3,200

$$\text{Composite index for actual farm} = \frac{3200}{2930} \times 100 = 109.2$$

---

[7] Working, E. J., "Crop Yield Index Numbers," *Journal of Farm Economics,* Vol. XXII, No. 4.

[8] *Ibid.,* p. 713.

The base yields per acre (Col. 2) refer to average yields of the state, the county, the average of the farms being studied, or any other base that might be selected. The base acreage (Col. 3) refers to the average number of acres in each crop for the base selected, i.e., the county, state, or the average for a group of farms. The price per bushel (Col. 4) may be the state or county average price, or the average price received by the farmers included in the group being studied. The weights (Col. 5) are obtained by multiplying the price by the base acreage. For example, the weight for corn is obtained by multiplying 70, the base acreage, by 80 (cents) which gives $56 (Col. 5). The weights for wheat and oats are obtained in a similar manner. These weights are then used to obtain the weighted values for base yields and the yields of a given farm. In the case of corn, the value at base yields is obtained by multiplying the base yield of 40 bushels by the weight, $56, which is equal to $2,240. The corresponding result for the given farm is the same since the yields are identical. The same process is repeated for wheat and oats. The sum of the weighted values is $2,930 for the base and $3,200 for the given farm. The index of yields, therefore, is 109.2, or the composite yield for these crops on the given farm is 9.2 per cent above the base.

The difference in the composite indices of yields, as obtained by these two methods (120 and 109.2), is significant and indicates the need for care in selecting the methods used. For ordinary purposes, or for an exploratory study, the first of these two indices may be used since it is much easier to compute.[9] But if the relation between, say productivity and net income, is the object of study, then it might be desirable not only to use the weighted aggregative type but to experiment with other types as well.[10]

---

[9] For a good discussion of this subject see "Methods of Calculating Index Numbers from Farm Management Data," S. A. Engene, Farm Management Statistical Clinic, University of Illinois, Sept. 10, 11, 1941, pp. 32–37.

[10] Working, E. J., "Crop Yield Index Numbers," *Journal of Farm Economics,* Vol. XXII, No. 4, p. 712.

5. Measuring Capacity and Efficiency

One of the chief difficulties of comparing farms is the variation in their capacity and efficiency. Normally, this is such a difficult problem that it is ignored, and the results obtained are, as a result, often faulty. Capacity and efficiency are very closely associated in an economic sense, and a much more effective discussion of them can be given if the two are considered together. First, it is necessary that we understand what is meant by the terms "capacity" and "efficiency." Capacity means the power of receiving or absorbing, or in other words, the power which anything has to associate itself with other things. For example, we mean by the capacity of land the amount of seed, fertilizer, horse labor, man labor, or other elements that it will use, or *capacity is the power of anything to use inputs.* Efficiency, on the other hand, has to do with the effectiveness with which the inputs are used. To illustrate, suppose there are two pieces of land on which are applied the same amounts of labor, fertilizer, and seed, but the amount of product obtained from one piece of the land is much greater than the amount obtained from the other. Then, it can be said that the land which yields the larger amount of products is higher in efficiency than the other.

Capacity and efficiency have a mathematical relationship which is expressed in the term "productivity," as: "Capacity times efficiency equals productivity." If we take the power of anything to absorb other elements and multiply it by the effectiveness with which these elements are used, we will get the total output or the productivity.

In the economic sense, both capacity and efficiency should be measured at the point of *highest net returns.* The economic capacity of an individual element of production will be based on the number of inputs of the other elements at the point of highest profit combination. On the other hand, economic efficiency will also be based upon the net outputs per unit of input at this same point. To illustrate this, Black[11] assumes the application of various units of the same kind of fertilizer on two tracts of land. The fertilizer is equally suited to each tract, but the point of highest net returns on one tract is reached when 9 units of fertilizer are added; whereas, 10 units must be applied to the other tract to get the maximum net returns. Therefore, the economic capacities of these tracts of land to use fertilizer will be 9 and 10 units respectively. The economic efficiency of each tract will be the net output per unit of input at the individual economic capacities of each tract.

6. Measuring the Success of the Farm Business

Next in importance to the problem of reducing a farm to a comparable basis is that of obtaining an adequate measure of success. Assuming that two farms being compared have been made as comparable as possible in accordance with methods already discussed, is it possible to say which one of these has been the more successfully operated and managed? To answer this question several measures have been developed which may be called collectively "measures of success." It is the purpose of this section to consider the more important of these. It should be pointed out that none is entirely satisfactory, and the same suggestion made relative to measure of size of the business is applicable here: namely, that there is no one universal test of success.

a. The *net farm income* may be defined as the gross income including increases in inventory less the cash expenses, any decrease in inventories, the depreciation on the capital goods employed, and an estimated value of the unpaid family labor. The method of calculating the farm income may be illustrated in the following manner:[12]

Cash receipts	$2,022	
Increase in inventory	78	
Total gross receipts		$2,100

---

[11] Black, *Production Economics,* Chapter XIII.

[12] The data are taken from Table 50.

Cash expenses	$1,344	
Depreciation	71	
Unpaid family labor	120	
Total expenses		$1,535
Net farm income		$ 565

b. *Labor income*[13] is the farm income as calculated above, less the interest on the total investment. It is calculated as follows:

Net farm income	$565
Less 5 per cent interest on $8,875	444
Labor income	$121

c. *Farm capital earnings* are the gross receipts including any increase in inventory less gross expenses including an estimate of the operator's labor. It is calculated as follows:

Gross cash receipts	$2,022	
Increase in inventory	78	
Total		$2,100
Less farm cash expenses	$1,344	
Less depreciation	71	
Less the value of unpaid family labor	120	
Less value of unpaid operator's labor	300	
Total		$1,835
Farm capital earnings		$ 265

---

[13] The labor income is sometimes adjusted for variations in the size of the farms. The adjustment is made in the following manner:

(a) The farms are grouped according to size. The class interval should be as narrow as possible, yet wide enough to include a sufficient number of farms in each class to give a reliable average income for each group.

(b) The labor income of each farm is stated in percentage of the average labor income of the group to which it belongs. This percentage is designated as the adjusted labor income.

By using the adjusted labor income the effect of size on labor income is removed, at least to a considerable degree. For example, if the labor income of a given farm is 80 per cent of the average of the group to which it belongs and another is 80 per cent of the average of its group, then these two farms may be considered as comparable, although the larger farm of the two may have a much larger labor income. (See *Farm Survey Manual,* issued January 7, 1916, by U. S. Department of Agriculture.)

d. *Farm family earnings* are the gross cash receipts, any increase in inventory, together with the value of the farm products used in the home less the cash expenses, any decrease in inventory, and depreciation.[14] It is calculated as follows:

Cash receipts	$2,022	
Inventory increase	78	
Farm products used in home	352	
Total		$2,452
Less cash expenses	$1,344	
Depreciation	71	
Total		$1,415
Farm family earnings		$1,037

e. *Profits* are the returns to the farmer as an entrepreneur or the reward for management. Profits are calculated as follows:

Gross cash receipts	$2,022		
Increase in inventory	78		
Total		$2,100	
Less cash expenses	$1,344		
Less depreciation	71		
Less family labor	120		
Less operator's labor	300		
Less rate on investment at 5% interest	444		
Total		$2,279	
Profits			$ -179

In this case the farmer failed to make any profit; that is, the gross income was insufficient by $179 to cover the actual and estimated farm expenses and interest on investment at 5 per cent. (See *Labor income.*)

f. *Cash income* is the difference between the cash receipts and the cash expenses.

---

[14] Income from outside sources is not usually included in farm family earnings.

Gross cash receipts	$2,022
Gross cash expenses	1,344
Net cash income	$ 678

g. *Rate of turnover.*[15] An index of success used frequently is the rate of turnover. The rate is determined by dividing the gross income by the total investment. For example, suppose the gross receipts of a given farm were $2,100 and the investment was $8,875, then the rate of turnover is $2,100 × 100 ÷ $8,875, or 23.7 per cent. In this case it would take approximately 4 years for the income to equal the investment.

If the rate of turnover is low, it may mean that the farmer has too much invested in land, livestock, machinery, or other factors of production relative to the gross income received. A low rate of turnover indicates, therefore, that the farmer should give attention to lowering his investment or to increasing his gross income perhaps through increasing his output.

h. *Rate of return on investment.* The rate of turnover expresses the relationship between the total investment and the gross income. The rate of return, on the other hand, is the relationship which exists between the total investment and the net income. The rate of return on investment for any given farm is found by dividing the net returns by the total investment involved. Thus, if the capital earnings of a farm are $265 and the investment $8,875, the rate of return is $265 × 100 ÷ $8,875, or 3.0 per cent. When this rate is high, it indicates that the farm has been operated efficiently, but it does not indicate that the farm is operated in such a manner as to obtain the maximum net returns. If the return is higher than that charged on borrowed funds, the farmer could perhaps consider borrowing and using additional funds for the purpose of expanding his farming operations. Just how much additional funds should be borrowed and how they should be used, if borrowed, can be determined only by a careful analysis of the farm business.

---

[15] Hopkins, *Farm Records,* Chapter 16.

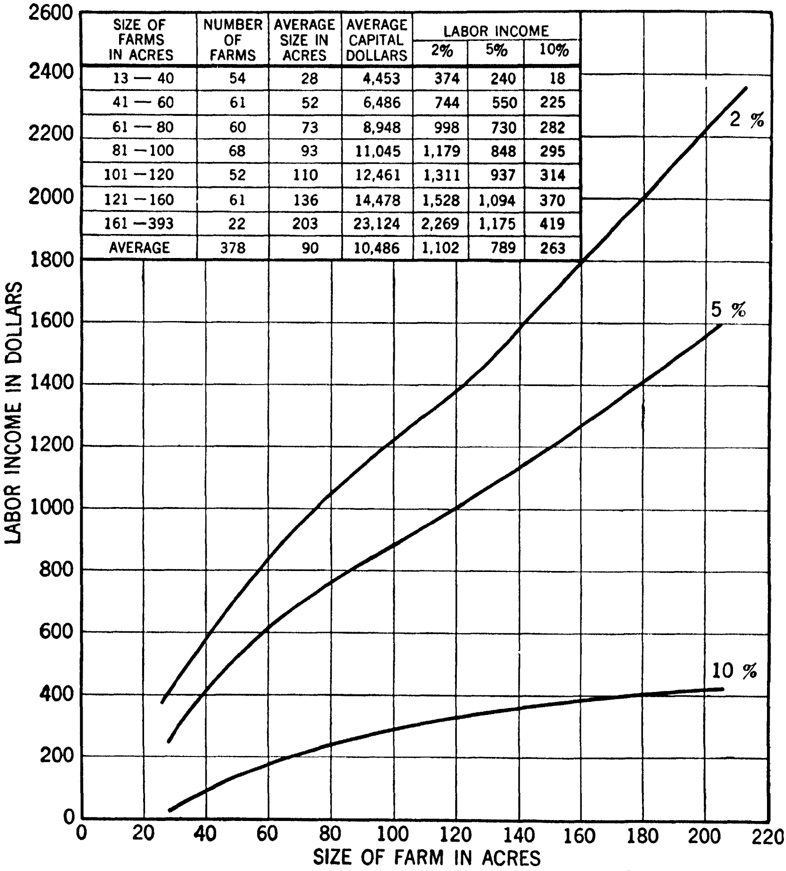
i. *The rate of return on net worth.* Another test, a variation of the rate of return, which may be used is the rate of return not on the total investment but on that part of the investment owned by the operator. This rate is calculated by dividing the net income less the cost of borrowed capital by the net worth or the equity which the operator has in his business. Suppose, for example, that the net farm income, exclusive of interest on borrowed capital, is $265 and that the cost of borrowing $2,000 at 5 per cent is $100, then the net income which could be attributable to the farmer's investment is $165; and if his net equity is $6,875 ($8,875 – $2,000), the rate of return on the net equity is 2.4 per cent ($165 × 100 ÷ $6,875).

This rate will indicate whether or not the rate earned on the owner's investment is higher or lower than the current rate or the rate at which the operator could borrow funds. If the rate earned is higher than the current rate, it indicates that the farm is being operated efficiently; but, if it is a lower rate, it may mean that the farmer is gradually using up his equity and that ways and means of improving the organization and operation of the farm should be employed.

7. Criticism of Measures of Success

It should be emphasized that the measures of general success described above simply indicate whether or not a farm has been organized and operated successfully, and they do not reveal precisely the cause or causes of success or failure. The causes, whatever they may be, can be determined only by subjecting the whole organization and method of management to a detailed analysis. The methods of analysis, insofar as organization is concerned, have been described already, more particularly in Chapters VI to IX. The subject of management will be treated in subsequent chapters.

It should be said also that the measures of general success are not all equally useful. Of those discussed, labor income and per cent return on investment are more commonly employed; and, while they are perhaps more reliable than other measures, they are none the less defective. The labor income is not reliable when farms varying in size are to be compared. The magnitude or size of the labor income is affected by the rate of interest used in determining the amount to be deducted for the use of capital. The higher



SIZE OF FARMS IN ACRES	NUMBER OF FARMS	AVERAGE SIZE IN ACRES	AVERAGE CAPITAL DOLLARS	LABOR INCOME		
				2%	5%	10%
13 — 40	54	28	4,453	374	240	18
41 — 60	61	52	6,486	744	550	225
61 — 80	60	73	8,948	998	730	282
81 —100	68	93	11,045	1,179	848	295
101 —120	52	110	12,461	1,311	937	314
121 —160	61	136	14,478	1,528	1,094	370
161 —393	22	203	23,124	2,269	1,175	419
AVERAGE	378	90	10,486	1,102	789	263

Data adapted from U.S.D.A. Bul. No. 34.

Fig. 23. How the rate of interest used in calculating the labor income affects the apparent relationship between the size of the farm and the labor income.

the rate of interest used, the lower the labor income. It so happens that when a low rate of interest is used, the labor income of larger farms is relatively higher than when a high rate of interest is used. This is illustrated in Figure 23. When the rate of interest used in calculating the labor income is 2 per cent, the small farms as compared to the large farms appear to be less well organized and managed than is the case when the rate used is 5 per cent or 10 per cent. The lower the rate used, the more exaggerated is the "efficiency" of larger farms. As the rate used has obviously no effect on the organization and management of the farms, the labor income as a measure of success is defective and likely to be misleading.

The rate of return on investment as a measure of success is also defective in that it is a function of efficiency rather than of capacity. That is to say, as farms become larger, the rate of return tends to decline. The rate of return on investment being higher on the smaller than on the larger farms tends to exaggerate the proficiency with which the smaller farms are organized and managed. Or to state it differently, the larger farms will tend to show a lower rate of return, because the efficiency with which the factors are used tends to be low. That is, the objective in this case is not to get the highest output per unit of input but rather to obtain the maximum net returns for the farm as a whole by associating with the management more of the factors of production. On the other hand, on the small farms, by necessity, the attention is centered on obtaining the maximum output per unit of input because of the relative scarcity, other than management, of factors of production. Hence, the rate of return tends to be much higher for the smaller than for the larger farms.

The general conclusion of this discussion may be stated broadly as follows. There is no perfect measure of the proficiency of the organization and management of farms. Any one of these measures commonly used is defective in some respect, but all may be used if care is exercised to adjust the farms to be compared to a comparable basis with respect to size, general type of organization and management employed, and other factors directly related to success.

TABLE 50

Farm Financial Statement

Acreage		*Capital*	
Crops	40	Land	$5,087
Cleared pasture	9	Improvements	2,218
Woods pasture	10	Livestock	402
Woods	59	Machinery	216
Other	18	Feed	167
		Cash	785
Total	136	Total	$8,875

Estimated value of family labor	$ 120
Estimated value of operator labor	300

Gross Receipts			*Expenses*		
Crop sales:					
Tobacco		$ 644	Wage labor		$ 221
Peaches		442	Cropper labor		242
Cotton and seed		383	Feed		73
Peanuts		74	Fertilizer		228
Truck crops		51	Taxes		103
Corn		48	Repairs:		
Irish potatoes		48	Machinery		26
Berries		44	Buildings, fences, etc.		26
Sweet potatoes		20	Livestock bought		31
Wheat		14	Improvements		80
Other crops		25	Other cash expenses		295
			Machinery bought		19
		$1,793			$1,344
Livestock and product sales:			Depreciation:		
Dairy products	$ 84		Machinery	$ 22	
Hogs	57		Improvements	44	
Poultry and eggs	50		Livestock	5	
Cattle	29				
Other	9				
		229			
Total cash receipts		$2,022	Total		71

TABLE 50—*Continued*

Gross Receipts			*Expenses*	
Inventory increases:				
Real estate	$ 36			
Livestock	17			
Machinery	5			
Feed	$20			
Total		$78		
Family living from the farm:				
Food	$317			
Wood	35			
Use of house	124			
			Total expenses	$1,415
Total		476	Total farm income	1,161
Total gross receipts		$2,576	Total	$2,576

Questions

1. Explain the source of difficulty encountered in an attempt to compare the sizes of various farms. What are the most commonly used bases of measurement?

2. What do we mean by (a) crop area equivalent, (b) animal unit, (c) productive work unit?

3. How are (a) diversity index, (b) single crop index, (c) composite crop index determined?

4. Differentiate between "capacity" and "efficiency." How are they related to productivity?

5. Name the measures of general success. Which is the most widely used bases of measurement?

References

Adams, R. L., *Farm Management.* New York: McGraw-Hill, 1921, Chapter I.

App, Frank, and Waller, Allen G., *Farm Economics.* Philadelphia: Lippincott, 1938, Chapter III.

Black, J. D., *Production Economics.* New York: Henry Holt, 1926, Chapter XXI.

Davidson, Jay Brownlee, *Agricultural Machinery.* New York: John Wiley and Sons, Inc., 1931, pp. 371–2.

Gray, L. C., *Introduction to Agricultural Economics.* New York: Macmillan, 1924, Chapter V.

Hopkins, John A., *Farm Records.* Ames, Iowa: Collegiate Press, 1936, Chapter II.

Johnson, Sherman E., et al., *Managing a Farm.* Madison, Wisconsin: United States Armed Forces Institute.

Warren, G. F., *Farm Management.* New York: Macmillan, 1916, Chapters IV and VI.

U. S. Department of Agriculture, *Farm Management Circular No. 1,* Jan. 7, 1926.

U. S. Department of Agriculture, *Farm Survey Manual,* Jan. 7, 1916.

CHAPTER XII

The Economics of Farm Practices

THERE are two main lines of approach to the farmer's problem of getting the maximum net returns out of the resources available to him. The first approach has to do with the enterprises which are included in the system of farming, dealing with both the kinds and the relative amounts of various enterprises to be included. (This subject has been treated in Chapters V to IX.) The second deals with the efficiency with which individual enterprises are conducted. Enterprise efficiency has become linked with the phrase "farm practices," and, to a slight extent, the term is used in a much broader and in a more indefinite manner referring to the system of rotation. But it is more correct to confine its use to the technical methods followed in the production of farm commodities. The purely technical phase of the problem must be dealt with, as far as scientific study is concerned, by workers in the fields of agronomy, agricultural engineering, animal husbandry, and the other technical or natural sciences related to agriculture. The problem of the time required by new or different practices and of the extent to which they should be incorporated into the farming program is, however, one of economic importance and one which is properly receiving considerable attention from farm economists.

1. Types of Farm Practices

Although embracing in its scope practically the entire field of agricultural technique as applied to production, the field of farm practices may be arbitrarily separated into three classes: (a) Those dealing with qualities and quantities of the factors of production or input factors; (b) those dealing with methods of applying the input factors; and (c) those dealing with the time the factors are applied, or *timeliness*. This is not at all a hard and fast classification, as some practices may fall in more than one of these classes. For example, introducing a new method of applying a factor may call for changes in amounts of the factor used. In the same way there is a definite relation between the farm practices, the cropping system, and the livestock program. There may be a considerable change in practices without any change in the organization; but many changes in practices may necessitate, or at least allow, changes in the entire plan of the farm. Additional labor or additional feed may be made available by the use of a new method of feeding. In such a case, the savings from the new practice may be nullified, in part at least, unless some provision is made to utilize this labor or feed, particularly if the labor is family labor and the feed unsalable.

2. Some Causes for Variation in Farm Practices

Even within narrow geographical limits farmers are found to use widely different practices in the production of specific farm commodities. Some farmers will be using more labor, more seed, or more fertilizer than others on the same crops. Other farmers will be found using combines for harvesting, others using binders or headers; some will be cutting and baling their hay; others will let their livestock graze it in the field, and so on. These differences in the practices used by farmers may be due to several causes. Perhaps the most important cause involves the physical differences in the natural resources available. Heavy soils increase plowing labor, and small fields with small-scale operations prevent the use of large-scale methods and machinery. Other causes of differences in practices include the knowledge and the ability of the farmers themselves and their varying responses to changing economic conditions. Many farmers change their practices rather slowly. Others are alert to change practices when conditions justify, and still others are forced to change some practices and at the same time are prevented from changing others, because of financial limitations and changes in the labor supply.

3. The Scientific Study of Farm Practices

Almost every phase of the technique of farm practices has been studied for at least a century. Workers in the fields of agronomy and of animal nutrition have for many years studied the relative efficiency of many different methods of culture and fertilization and of handling and feeding livestock, always with the idea of determining the most profitable practice to be used. It was not until in the early part of the twentieth century, however, that workers in the fields of farm management and of farm economics began to study farm practices and to analyze the data compiled by the technical workers. Prior to 1920, no less than twenty studies were made by the United States Department of Agriculture in which the term "farm practices" was embodied in the title.[1] (See Chapters II and III.) Many other studies made in this early period, particularly case studies of model farms in different type-of-farming areas, included farm practices as a major objective. Methods developed and refined in recent years have helped to make more specific and more valuable these research investigations. These studies usually take one of two forms. In the first type of study the data are obtained from controlled experiments. Much of this type of data can be improved in practical value when it is given an economic interpretation. This involves applying prices and cost rates to all physical inputs and outputs and, when possible, giving the data a practical slant by presenting it in a form better adapted to the farmer's use. In the second type of study the data are obtained directly from farmers; that is, data pertaining to a practice or to practices are collected from a number of farms, and the most economical practice is determined by a mathematical study of the relationship between inputs and outputs. In some cases, multiple and partial correlation analyses are used in the determination. In others, cross tabulation and calculation of averages serve to point out the best practices. Many studies of this type are more or less by-products of farm organization studies or cost of production studies in a given area.[2]

---

[1] "Report of Chief, Office of Farm Management and Farm Economics," year ending June 30, 1922, pp. 13–22.

4. Controlled Experiments

Let us consider first the data obtained from controlled experiments. State and federal authorities, as well as agents of private institutions, have conducted numerous controlled experiments of one kind or another with the object of determining what combination of the factors of production is best suited to given conditions. On the basis of the results obtained, they have suggested what have been called "profitable" combinations. Such, at least, has been the major objective of the fertilizer, feeding, and seeding tests, as well as of the experiments in the best manner of producing specific crops, such as the "best" number of cultivations, "proper" depth of plowing, and the "right" type of machinery to use. The fact is that there is now a considerable body of knowledge that, when subject to economic analysis, may be helpful to farmers in obtaining the maximum utilization of the factors of production over which he has control.

The nature of these experiments and the results obtained are illustrated in Table 51, in which is presented an experiment in the application of fertilizer to a given area of land of a uniform grade. This experiment shows how the production of seed cotton behaves when attempts are made to increase production by the application of a mixed fertilizer that has been applied at the rate of 100 pounds per acre (Column 2). As a result of the increases in the quantity of fertilizer used, the production of seed cotton per acre increased (see Column 3) from 517 pounds when no fertilizer was used to 1,281 pounds when the 1,600 pounds of fertilizer were used. Although production increased with an increase in fertilizer, it did not increase as rapidly as the fertilizer increased (Column 4). Or the production increased, but at a diminishing rate.

---

[2] "Input as Related to Output in Farm Organization and Cost of Production Studies," *Bulletin No. 1277.*

5. Practical Experimentation

Farmers have not relied solely, indeed in many cases they have not relied at all, on the results of controlled experiments for their knowledge of how best to combine the factors of production. The combinations that they use are based largely on experience, customs, and traditions. One writer has said that every farm is an experiment station and the farmer the director thereof.[3] This statement is, of course, more poetical than factual, as the actual amount of experimenting which any farmer does is probably small, as there is a strong tendency for him to do the same things in about the same way year after year. And when farmers do experiment, the results, if available, are seldom in usable form. What is true, however, is that different farmers in the same agricultural area may be doing the same things quite differently. It is from the study of what farmers are actually doing rather than from practical experiments made by individual farmers that helpful suggestions may be obtained relative to the most desirable combination of the factors.

The collection and the analysis of such data are both difficult tasks. When the data relating to the different farms in a homogeneous area are properly collected and

---

[3] A statement attributed to Liberty Hyde Bailey.

TABLE 51

EFFECT OF SUCCESSIVE APPLICATIONS OF FERTILIZER ON THE YIELD OF SEED COTTON PER ACRE[a]

1 *Combination*	*2* *Fertilizer Input (Cwt.)*	*3* *Total Output (Pounds)*	*4* *Additional Output (Pounds)*	*5* *Average Output Per Unit of Fertilizer (Pounds)*
1	0	517	....	....
2	1	624	107	624.0
3	2	723	99	361.5
4	3	814	91	271.3
5	4	898	84	224.5
6	5	973	75	194.6
7	6	1,040	67	173.3
8	7	1,100	60	157.1
9	8	1,152	52	144.0
10	9	1,195	43	132.8
11	10	1,231	36	123.1
12	11	1,259	28	114.5
13	12	1,279	20	106.6
14	13	1,292	13	99.4
15	14	1,296	4	92.6
16	15	1,292	–4	86.1
17	16	1,281	–11	80.1
18	17	1,261	–20	74.2

---

[a] South Carolina Experiment Station, *Bulletin No. 219*, p. 9.

analyzed, results which resemble those obtaind from controlled experiments are obtained. One or two examples may be given by way of illustration.

In Table 52 are presented data showing the yields of potatoes resulting from the use of varying amounts of fertilizer and manure. Increased amounts of fertilizer give, as might be expected, increased yields. The relation here, however, is more apparent than real, for it is impossible to state definitely whether fertilizer or some other factor is causing the variation in output; that is, the experiment is not controlled. Such being the case, statistical techniques are necessary by which this may be accomplished. When all other factors affecting yield are held constant, the real relation is revealed. Such results, when the effect of other factors is eliminated, are shown in Table 53. Each increment of fertilizer is expressed in units of $2.50. The net increase resulting from the application of one unit ($2.50) is 8 bushels. When two units ($5.00) are applied, the total net increase is 15.5, or an additional increase due to an additional dose of fertilizer of 7.5 bushels. Production continues to increase up to the seventh unit, when 33 bushels are added to the total. But the increase due to an additional unit declines from 8 bushels for the first $2.50 to 1 bushel for the last $2.50 worth of fertilizer applied.

TABLE 52

Apparent Effect of Fertilizer on the Potato Yield[a]

1	*2*	*3*
Value of Fertilizer Applied per Acre	*Output per Acre (Bushels)*	*Output Per Dollar's Worth of Fertilizer (Bushels)*
$0.00 to $5.49	103.1	26.4
5.50 to 10.49	114.1	15.0
10.50 to 15.49	132.9	10.4
15.50 to 20.49	132.1	7.5

[a] U. S. Department of Agriculture, *Bulletin 1277*, p. 16.

From the data collected in connection with the above study it was found that increasing the amount of seed per acre tended to increase the yield. The results are shown in Table 54. In this case the increase in yield is due solely to increase in the seed planted, as the other factors such as the amount of fertilizer, number of cultivations, and depth of plowing have been held constant. With 10 bushels of seed per acre, the resulting production is 100 bushels; with 12 bushels of seed per acre, the resulting production is 118 bushels; and with 18 bushels of seed per acre, the produc-

TABLE 53

NET INCREASE IN THE YIELD OF POTATOES DUE TO SUCCESSIVE INCREMENTS OF MANURE AND FERTILIZER [a]

1	*2*	*3*
Value of Manure and Fertilizer Applied	*Total Increase (Bushels)*	*Increment (Bushels)*
$2.50	8	8
5 00	15 5	7.5
7 50	22	6.5
10 00	27	5
12 50	30	3
15 00	32	2
17 50	33	1

[a] U. S. Department of Agriculture, *Bulletin 1277*, p. 18.

TABLE 54

RELATION BETWEEN SEED PLANTED AND YIELD OF POTATOES PER ACRE [a]

1	*2*	*3*
Seed Planted per Acre (Bushels)	*Adjusted Potato Yield (Bushels)*	*Increase in Yield Due to Increase of 1 Bushel in Seed Input (Bushels)*
10	100	....
12	118	9 0
14	132	7.0
16	143	5 5
18	152	4.5

[a] U. S. Department of Agriculture, *Bulletin 1277*, p. 18.

tion is 152 bushels. In the case of seed, as was found in the case of fertilizer, the production of potatoes increased with an increase of seed but, as indicated in Column 3, at a diminishing rate.

6. The Law of Diminishing Productivity

In most of the illustrations of this type, land is the fixed factor. It is well to point out that the same general results would be obtained if any of the factors other than land were fixed. That is to say, if fertilizer were fixed and land varied, the production would tend to increase but not as rapidly as the land increased. In order to avoid any misunderstanding it should be stated that in some instances production at the outset may increase more rapidly than the variable factor, resulting in what is known as *increasing returns*. But as the variable factor is increased, a point will be reached at which the production will not increase as rapidly as the variable factor, and at such a point *diminishing returns* sets in. Finally, if the applications are pushed far enough, a point will be reached at which the total absolute production will decline. There are, then, three possible stages in production: (a) the stage or condition in which the physical output is increased at a more rapid rate than the variable factor; (b) the stage in which the production is increased, but not as rapidly as the variable factor is increased; and (c) the stage in which the total output declines.[4] Normally in agriculture the first and third stages are of no great significance. In most cases, returns diminish from the beginning, and no farmer knowingly will continue to add supplementary or auxiliary factors until a point is reached at which the total production declines. We may summarize by saying that in any attempt to increase production by increasing an auxiliary factor, the production will increase but not as rapidly as the auxiliary factor. This statement is usually designated as the *law of diminishing productivity.* It should be pointed out that this law is predicated on the assumption that at least one of the factors is fixed. If, in any given case, all the factors are increased at the same rate, the total output will increase in the same proportion. That is to say, there will be no tendency toward diminishing returns. But as a rule, this law is of universal application because one or more of the factors are usually fixed either relatively or absolutely.[5]

---

[4] Taylor, *Principles of Economics*, p. 124.

7. Determining the Most Profitable Combination of Inputs

Various attempts have been made to state from experimental and practical data precisely how far a farmer should go in the application of such factors of production as fertilizer and labor to land, or how far he should go in the feeding of livestock. In not a few instances the advice given has been bad. For instance, it has often been said that the goal of the farmer should be to obtain the maximum output of the fixed factor, or in the case of land the farmer should strive for maximum yields. Others have contended that the farmer should try to get the maximum output per unit of the variable factor, such as the maximum output per unit of fertilizer, seed, or labor. But the question as to how far the farmer should go in the utilization of auxiliary factors, or, to be more precise, just what combination of input factors of production is best, cannot be definitely determined simply by observing the physical results of experiments. To obtain the maximum net returns, it is necessary to consider also the effect of the price of land, labor, and capital, and the price of the output. For example, if fertilizer is cheap as compared to land or relative to the price of the product, the farmer will tend to increase the amount of fertilizer used; and, when fertilizer is expensive relative to the price of other factors and the price of the product, he will tend to diminish the application of fertilizer. This, however, is a statement of a tendency, and it is not an answer to the question as to just what combinations of the various factors the farmer should at any given time strive to attain.

---

[5] Carver, in his *Distribution of Wealth,* Chapter II, makes a distinction between the law of diminishing returns and the law of increasing or decreasing economy of large-scale production. Probably no such distinction can be drawn, because large-scale operation is mainly a problem of adjusting entrepreneurial ability to the other factors of production. Large-scale production is simply one phase of the law of combining proportions. See also Clark, J. M., *The Economics of Overhead Cost,* p. 84.

It is probably true that no definite answer is possible, but we can throw some light on the nature of the problem by studying carefully the results of actual farm data and of controlled experiments. For purposes of illustration, we may employ the data on cotton presented in Table 51, and assume that this represents a given farmer's condition. To simplify matters, we may assume further that the farmer is interested in only the production of cotton and that his land is *uniform* in quality.

How does production respond to inputs of fertilizer on this farm? As is shown by the table, the farmer is able to obtain 517 pounds of seed cotton per acre without using any fertilizer. But, as shown in Column 4, he is able through the successive application of fertilizer in 100-pound units to increase his production per acre, at least to the point where 1,400 pounds of fertilizer is added. Any attempt to increase production beyond this point is defeated. That is to say, absolute production declines after the 1,400 pounds per acre have been applied. Now if this particular farmer is engaged in a contest, the object of which is to get the maximum physical yield per acre, he would be justified in applying at least 14 units of fertilizer, or perhaps a quantity slightly in excess of this amount. On the other hand, if he is interested in getting the maximum physical returns per unit of fertilizer, he would not be justified in going beyond the application of 100 pounds, for it is at this point that he gets the highest returns per unit of fertilizer applied. (See Table 51, Column 5.) But, as already observed, if the farmer's object is to obtain the maximum net economic returns, neither of these combinations is correct.

a. *Least-cost analysis.* One method of solving this problem is called least-cost analysis, the basic data for which are presented in Table 55. In Table 56 the inputs of land, labor, seed, and other costs have been expressed in terms of inputs per unit of output. It will be observed that as the

TABLE 55

COMBINATIONS OF INPUTS AND RESULTING OUTPUTS OF SEED COTTON PER ACRE

1 Combination Number	*2* Fertilizer Applied per Acre (Cwt.)	*3* Seed Applied per Acre (Pounds)	*4* Man Labor Used per Acre (Hours)	*5* Horse Labor per Acre (Hours)	*6* Other Items of Cost ($)	*7* Total Production (Pounds)
1	0	30	107	50	10.00	517
2	1	30	119	50	10.27	624
3	2	30	130	50	10.52	723
4	3	30	140	50	10.74	814
5	4	30	150	50	10.95	898
6	5	30	159	50	11.14	973
7	6	30	167	50	11.31	1,040
8	7	30	174	50	11.46	1,100
9	8	30	180	50	11.59	1,152
10	9	30	185	50	11.70	1,195
11	10	30	189	50	11.79	1,231
12	11	30	192	50	11.86	1,259
13	12	30	194	50	11.91	1,279
14	13	30	195	50	11.94	1,292
15	14	30	195	50	11.95	1,296
16	15	30	195	50	11.94	1,292
17	16	30	194	50	11.91	1,281
18	17	30	192	50	11.86	1,261

output increases, owing, of course, to the application of fertilizer, the input of each factor per unit of output declines except in the case of fertilizer, the inputs of which increase. The reason for this is obvious. Either land, labor, seed, and other costs are fixed, or they are not increasing as rapidly as the output; hence, any increase in total output means that the amount of input per unit of output must decline. But fertilizer is increasing more rapidly than the output; hence, the input of fertilizer per unit of output must increase.

To obtain the per unit cost of output for each combination, it is only necessary to multiply the units of input by the price of the cost good in question. To illustrate the problem, land has been charged at the rate of $10 per acre; fertilizer, $40 per ton; seed, 2 cents per pound; man labor, 20 cents per hour; horse labor, 10 cents per hour; and other

TABLE 56

INPUTS PER UNIT OF OUTPUT OF SEED COTTON [a]

1 *Combination Number*	*2* *Input of Fertilizer per Unit of Output (Cwt.)*	*3* *Input of Seed per Unit of Output (Pounds)*	*4* *Input of Land per Unit of Output (Acres)*	*5* *Input of Man Labor per Unit of Output (Hours)*	*6* *Input of Horse Labor per Unit of Output (Hours)*	*7* *Other Costs per Unit of Output ($)*
1	.000	5.802	.193	20.696	9.671	1.934
2	.160	4.807	.160	19.070	8.013	1.646
3	.277	4.149	.138	17.980	6.916	1.455
4	.368	3.685	.123	17.199	6.143	1.319
5	.445	3.340	.111	16.703	5.568	1.219
6	.514	3.083	.103	16.341	5.139	1.145
7	.577	2.884	.096	16.057	4.808	1.087
8	.636	2.727	.091	15.818	4.545	1.042
9	.694	2.604	.087	15.625	4.340	1.006
10	.753	2.510	.084	15.481	4.184	0.979
11	.812	2.437	.081	15.353	4.062	0.958
12	.874	2.382	.079	15.250	3.971	0.942
13	.938	2.345	.078	15.168	3.909	0.931
14	1.006	2.321	.077	15.092	3.870	0.924
15	1.080	2.314	.077	15.046	3.858	0.922
16	1.161	2.321	.077	15.092	3.870	0.924
17	1.249	2.341	.078	15.144	3.903	0.930
18	1.348	2.379	.079	15.226	3.965	0.941

---

[a] Unit = 100 pounds of seed cotton.

This table is derived from Table 57 by dividing the various inputs for each combination by the corresponding total output; for example, 107 hours of labor ÷ 517 pounds of seed cotton = 20.696 hours of labor input for each 100 pounds of seed cotton.

costs, varying from $10.00 to $11.86 per acre. Each class of input, or fraction thereof, has been multiplied by these rates. After the inputs have been expressed in terms of value, they may be added. This will give the cost of producing a unit of product for each combination. As shown in Table 57, the cost of each combination, when calculated as thus described, varies from $9.086 per 100 pounds in the first combination to as low as $6.875 per 100 pounds in the ninth combination and then rises again to $7.915 for the eighteenth combination (Column 8).

TABLE 57

COST OF COMBINATIONS OF INPUT PER UNIT OF OUTPUT [a]

1	2	3	4	5	6	7	8
	Cost per Unit of Output [b]						
Combination Number	*Fertilizer @ $2 per Cwt.*	*Seed @ 2¢ per Pound*	*Land @ $10 per Acre*	*Man Labor @ 20¢ per Hour*	*Horse Labor @ 10¢ per Hour*	*Other Costs*	*Total*
1	$.000	$.116	$1.93	$4.139	$.967	$1.934	$9 086
2	.321	.096	1.60	3.814	.801	1.646	8.278
3	.553	.083	1.38	3.596	.692	1.455	7.759
4	.737	.074	1.23	3.438	.614	1.319	7.412
5	.891	.067	1.11	3.340	.557	1.219	7.184
6	1.028	.062	1.03	3.268	.514	1.145	7 047
7	1.154	.058	.96	3.210	.481	1.087	6.950
8	1.273	.055	.91	3.163	.454	1.042	6.897
9	1.389	.052	.87	3.124	.434	1.006	6.875
10	1.507	.050	.84	3.096	.418	0.979	6.890
11	1.624	.049	.81	3.070	.406	0.958	6.917
12	1.747	.048	.79	3 050	.397	0.942	6 974
13	1.876	.047	.78	3.033	.391	0.931	7.058
14	2.012	.046	.77	3.018	.387	0.924	7.157
15	2.160	.046	.77	3.009	.386	0.922	7.293
16	2.322	.046	.77	3.018	.387	0.924	7.467
17	2.498	.048	.78	3.028	.390	0.930	7.674
18	2.696	.048	.79	3.044	.396	0.941	7.915

---

[a] This table has been prepared from data in Table 58. The input per unit of output has been multiplied by the rates shown in each column, except " other costs " which have been expressed directly in dollars.

[b] Unit = 100 pounds of seed cotton.

This cost-analysis, although significant in showing the effect of changing output on unit costs, does not indicate or prove that a farmer should attempt to obtain the least-cost combination of inputs. On the contrary, the farmer's objective is to obtain the maximum net return combination. To obtain this result, it will be necessary, as a rule, to go somewhat beyond the least-cost combination. This fact is illustrated in Table 58. The cost per unit of output as shown in Column 3 of Table 58 is the same as that in Table 57, Column 8. The income for each combination has been calculated for five different prices: namely, five.

TABLE 58

MOST PROFITABLE COMBINATION OF INPUTS WITH VARYING PRICES FOR SEED COTTON

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Combination Number	*Output (Cwt.)*	*Cost per Cwt. of Output*	*Net Returns per Acre When Price Is:*[a]				
			$5 per Cwt.	*$10 per Cwt.*	*$15 per Cwt.*	*$20 per Cwt.*	*$25 per Cwt.*
1	5.17	$9 086	$—21 12	$4.73	$30.58	$56.43	$82.28
2	6 24	8.278	—20.45	10.75	41.95	73 15	104.35
3	7.23	7.759	—19.95	16.20	52 35	88.50	124.65
4	8 14	7.412	—19.63	21.07	61.77	102.47	143.17
5	8 98	7.184	—19.61	25.29	70.19	115.09	159.99
6	9 73	7 047	—19.92	28.73	77.38	126.03	174.68
7	10 40	6 950	—20 28	31.72	83 72	135.72	187.27
8	11.00	6 897	—20.87	34 13	89.13	144.13	199.13
9	11.52	6 875	—21.60	36.00	93.60	151 20	208.80
10	11.95	6.890	—22.59	37.16	96.91	156 66	216.41
11	12 31	6.917	—23.60	37.95	99.50	161.05	222.60
12	12.59	6 974	—24 85	38.10	101 05	164 00	226.95
13	12 79	7 058	—26.32	37 63	101.58	165.53	229.48
14	12.92	7.157	—27.87	36.73	101.33	165 93	230.53
15	12.96	7 293	—29 72	35 08	99 88	164 68	229.48
16	12.92	7.467	—31 87	32.73	97 33	161 93	226.53
17	12.81	7 674	—34 25	29.80	93 85	157.90	221.95
18	12.61	7.915	—36.76	26 29	89.34	152 39	215 44

[a] Profit for each combination is obtained by multiplying the cost per unit by number of units of product and subtracting this product from the product of the number of units and price; for example, (5.17 x $10) — (5.17 x $9.086) = $4.73.

ten, fifteen, twenty, and twenty-five dollars per 100 pounds of seed cotton. The income is determined by multiplying the production in the case of each combination (Column 2) by the price of seed cotton. The gross income for each combination for these five different prices is, however, not shown in the table. The net return for each combination is obviously the difference between gross income (yield × price) and the total cost (cost per unit × yield).

The net return for any combination is affected by the output, by the cost per unit, and by the price of the product. When the price of seed cotton is $5 per 100 pounds, the least-"loss" combination is No. 5. But if the price is $10 per hundredweight, the most profitable combination is No. 12; and when the price is $15, the highest net return combination is No. 13. This means that if there is no change in the cost rates, any advance in price of the product will necessitate a more intensive utilization of the fixed factors. This is brought about in this case by increasing the amount of fertilizer.

It should be emphasized that the maximum net return combination cannot be less than the least-cost combination, although it may be greater. When the price of the output is just equal to the unit cost in the least-cost combination, the net income will be zero, because at this point the total production times the price will equal the product of the production times the cost per unit. All other combinations will show a net loss. When the price of the product is less than the unit cost in the least-cost combination, all combinations, including the least-cost, will show a net loss. The least-loss, however, will appear before the least-cost combination (see Table 58, Column 4). Finally, when the price of the output is greater than the cost per unit in the least-cost combination, the maximum net returns will always be obtained in some combination following the least-cost combination. The exact location of the maximum-profit combination depends on the price; the higher the price, the more advanced will be the combination.

b. *Marginal Analysis.* This problem can be solved more directly by using the method of marginal analysis. According to this method, the maximum net returns will be obtained at that combination of inputs in which the *marginal cost* is equal to the *prices* of the product. Marginal cost is a *unit* concept obtained by dividing the added cost by the corresponding added output. When this added cost per unit is equal to the price of the product, net returns will be at a maximum.

It is obvious why this condition must be true. As the cost per unit of the added output declines, the price remaining constant, there is an increment of increase in net returns. However, just as soon as the marginal cost is equal to the price of the product, net increment disappears, i.e., price minus marginal cost equals zero. If an attempt is made to increase output after this situation has been reached, net income will decline for the simple reason that marginal cost exceeds the price of the product.[6]

This method of solving the problem may be applied to the identical data used in *least-cost* approach. The needed information is presented in Table 59. Column 1 represents the combination of inputs; Column 2, the total production for each combination of inputs; Column 3 is the additional production, or the amount by which the production of any combination exceeds the preceding combination; in Column 4 is presented the total cost for each combination of inputs; while Column 5 contains the added total cost. To obtain the marginal cost it is necessary to divide the data in Column 5 by the data in Column 3; or divide added cost by the corresponding added output. The results of this division are shown in Column 6. Finally, Columns 7 and 8, net returns are given for each combination of inputs, under prices for output of $10 and $20 per hundredweight.

From these data it is possible to test the concept that net

---

[6] This will be true only when price of product is equal to or greater than cost per unit in the least-cost combination. When price is less than cost in this combination all combinations will show a loss.

TABLE 59

Marginal Costs, Marginal Net Returns, and the Most Profitable Combination of Inputs

1	2	3	4	5	6	7	8
Combination Number	*Output of Seed Cotton (Cwt.)*	*Additional Output (Cwt.)*	*Total Cost*	*Total Added Cost*	*Marginal Cost per Cwt.*	*Total Net Returns at—*	
						$10 per Cwt.	*$20 per Cwt.*
1	5.17	5.17	$46.97	$	$	$ 4.73	$56.43
2	6.24	1.07	51.65	4.68	4.37	10.75	73.15
3	7.23	.99	56.10	4.45	4.49	16.20	88.50
4	8.14	.91	60.33	4.23	4.65	21.07	102.47
5	8.98	.84	64.51	4.18	4.98	25.29	115.09
6	9.73	.75	68.57	4.06	5.41	28.73	126.03
7	10.40	.67	72.28—	3.71	5.54	31.72	135.72
8	11.00	.60	75.87	3.60	6.00	34.13	144.13
9	11.52	.52	79.20	3.33	6.40	36.00	151.20
10	11.95	.43	82.34	3.14	7.30	37.16	156.66
11	12.31	.36	85.15	2.81	7.81	37.95	161.05
12	12.59	.28	87.80	2.65	9.46	**38.10**	164.00
13	12.79	.20	90.27	2.47	12.35	37.63	165.53
14	12.92	.13	92.47	2.20	16.92	36.73	**165.93**
15	12.96	.04	94.52	2.05	51.25	35.08	164.68

returns will be maximized when the marginal cost is equal to the price of the product. In the first instance when the price of the seed cotton is $10 per cwt., the maximum net return is obtained somewhere between combinations 12 and 13, probably very close to combination 12 since the net income shows a distinct tendency to increase up to combination 12 but drops in combination 13. The marginal cost for combination 12 is $9.46 per cwt., or very close to the price of seed cotton. As the price of the output increases from $10 to $20 per cwt., marginal costs remaining the same, the combination at which net returns reach a maximum is advanced; thus it pays to associate more of the variable factors with those which are fixed. It can be shown also that as the level of marginal costs declines, price remaining the same, it would pay to associate more of the variable factors with those which are fixed.

8. Conclusions

In this discussion it has been tacitly assumed that the means of production available to the farmer remain unchanged. It may happen, indeed it is always happening, that new types of machinery or improved old types are available to the farmer. It is also true, because of continued technical research, that new farm practices are developed or old ones modified. As a result of these things, the costs per unit of output may decline. This decline in production costs, however, is not a refutation of the law of diminishing returns. Over a period of time unit costs may rise or fall, depending on the technological improvement, the farmer's knowledge of farm practices, and his changing ability as an entrepreneur. But the law of diminishing returns, as stated in this chapter, applies only to a given set of conditions at a given time. If over a period of time unit costs decline, for the reasons already stated, this does not mean that the farmer will be in a position to make a higher income because his costs per unit may be less in the future than now, or are less now than for some former period. Generally speaking, the prices of farm products will change as unit costs change, i.e., prices tend to follow unit costs over a period of years.

The question of decreasing unit costs, although often confused with diminishing returns, constitutes a distinct problem. For example, an industry that is characterized by decreasing unit costs will be faced at any given time by the law of diminishing returns. The entrepreneur will have to decide now how he is going to allocate the various factors of production, over which he has control, in the making of the product or products in which he is interested. Faced with this problem, he will so distribute his resources as to obtain equal marginal production from each unit of resources used. Such an allocation will give him the maximum net returns for his business. True, next year this allocation may be changed because of technological improvement, but now, today, he must deal with conditions as they are. (See Chapter VI.)

Questions

1. Distinguish between systems of farming and farm practices as a means of increasing farm income.
2. Classify farm practices.
3. State the principal causes of variation in farm practices.
4. Indicate the precise nature of controlled experiments.
5. What is the nature of practical experimentation?
6. Describe briefly the least-cost-combination analysis.
7. What is meant by marginal analysis?
8. What affects the maximum net returns for the enterprise as a whole?

References

Black, J. D., *Production Economics.* New York: Henry Holt, 1926, Chapters XI and XII.

Boss, Andrew, *Farm Management.* New York: Lyons and Carnahan, 1923, Chapter XVII.

Clark, J. M., *Economics of Overhead Cost.* Chicago: University of Chicago Press, 1923.

Holmes, C. L., *Economics of Farm Organization and Management.* Boston: Heath, 1928, Chapters XI, XII, and XIV.

Taylor, F. M., *Principles of Economics.* New York: Ronald, 1921, Ninth Edition.

U. S. Department of Agriculture, *Department Bulletin 1277*, "Input as Related to Output in Farm Organization and Cost of Production Studies," by H. R. Tolley, J. D. Black, and M. J. B. Ezekiel.

U. S. Department of Agriculture, *Department Bulletin 1400*, "Factors Affecting Farmers' Earnings in Southeastern Pennsylvania," by M. J. B. Ezekiel.

U. S. Department of Agriculture, *Report of Chief, Office of Farm Management and Farm Economics,* June 30, 1922.

CHAPTER XIII

The Economics of Farm Practices (*Continued*)

THE possibility of increasing net farm income through the adoption of better methods of performing farm tasks is indicated roughly by a classification of basic tasks. Such a classification is presented in Table 60. The first thing that impresses one is the large number of tasks that the farmer has to perform. Actually, there are hundreds of tasks which the farm operator must do in the course of the year. There is, then, an opportunity to add to the net income, even if the efficiency with which each task is done is only slightly increased.

The second fact about farm tasks is that some are more important than others. The success of the farm enterprise will depend, therefore, on a recognition by the farm operator of the relative importance of each task and then on his giving the key tasks the most careful attention. In the case of some enterprises, there are certain tasks the performance of which determines the success of the enterprise. These may be called *critical* tasks. For example, in the production of flue-cured tobacco all tasks are, of course, essential. But after the tobacco has been produced, the one critical task is that of curing. A slip in the performance of this task—either getting the temperature in the barn too high or failing to advance the temperature as dictated by the conditions of the leaf—may mean a reduction in the value or a total loss of the tobacco. The care which the farmer gives his sows at farrowing time may mean the difference between success or failure of the hog enterprise. There are many such critical tasks, both in the production of crops and in livestock products.

TABLE 60

A Classification of Farm Tasks

I. Preliminary tasks or those required before production begins:

1. Clearing land.
2. Cleaning ground and removing debris.
3. Draining or irrigation.
4. Terracing.
5. Subsoiling.
6. Construction of buildings and fences.
7. Laying out fields, roads, lanes, etc.
8. Building.

II. Crop production tasks:

1. Plowing.
2. Disking.
3. Harrowing.
4. Running rows.
5. Ridging or bedding.
6. Applying fertilizer, lime, or other plant food.
7. Planting, seeding, drilling, transplanting.
8. Smoothing or rolling seed bed.
9. Cultivating.
10. Hoeing.
11. Thinning or chopping.
12. Topping and suckering.
13. Spraying or dusting.

III. Livestock production tasks:

1. Breeding and mating.
2. Culling.
3. Feeding.
4. Mixing feed.
5. Hauling feed.
6. Grooming.
7. Vaccinating, dosing, etc.
8. Cleaning stables, pens, hauling manure, etc.
9. Milking, gathering eggs, and other similar tasks.

IV. Harvesting and marketing tasks:

1. Cutting hay, corn, etc.
2. Reaping wheat or other small grain.
3. Hauling crops and products.
4. Storing crops and products.
5. Grading, packing, and crating products.

TABLE 60—*Continued*

V. Managerial tasks:

1. Planning the combination of enterprises.
2. Selecting the kinds of fertilizer to use.
3. Selecting the seed and feed to be used.
4. Supervising the farm labor.
5. Making minor adjustments in the operation of the farm.
6. Making market contacts.
7. Selling farm products.
8. Keeping records and accounts.

The third thing to be considered is the number of ways in which a given task may be done. Some of these ways are more efficient than others. Some are adequate under certain conditions, which might be inadequate under different conditions. Some farmers can use one method effectively, while others cannot use it at all, or, if they use it, they cannot obtain satisfactory results. All of these characteristics present opportunities whereby an operator may increase his farm income by studying the appropriate methods to be used for a given farm task. Although there is no set of rules or principles that will hold true with respect to the adoption of methods, nevertheless, a study of the way in which tasks may be performed will be helpful in improving the efficiency with which farm work is done. In this way the farmer may add materially to the net farm income.

1. The Relation of Specific Tasks to Income

There are no data available which show the net effect on farm income of performing farm tasks. Wilcox, Boss, and Pond[1] studied the effect of farm practices on farm income by the method of association. These investigators associated the number of "approved" practices for selected enterprises with the income received. (See Table 61.) In their study of the dairy enterprise the number of approved practices used by the farmers was associated with the income per cow. Those farmers who were using 6 or less of 12 approved practices received $67 per cow above the cost of feed; those employing from 6 to 9 obtained $72 per cow; while those who were using 10 to 12 practices obtained $87. Thus there was a difference of $20 per cow between the farms using 6 or less "approved" practices and those using from 10 to 12. In the case of the hog enterprise, the difference between the extreme groups was $1.72 per 100 pounds of pork produced; and in the case of poultry enterprise the difference was $1.38 per 100 hens. These data, although defective in that they do not show the net effect of practices on income, do indicate that variations in income are due in part to the practices used. There is no doubt that other things influenced the favorable income of farmers who were following approved farm practices, but in spite of this it is clear that approved farm practices in the feeding of livestock are im-

---

[1] Wilcox, Boss, and Pond, "Relation of Variations in the Human Factors to Financial Returns in Farming."

TABLE 61

DAIRY, HOG, AND POULTRY RETURNS ASSOCIATED WITH THE NUMBER OF SELECTED FARM PRACTICES FOLLOWED

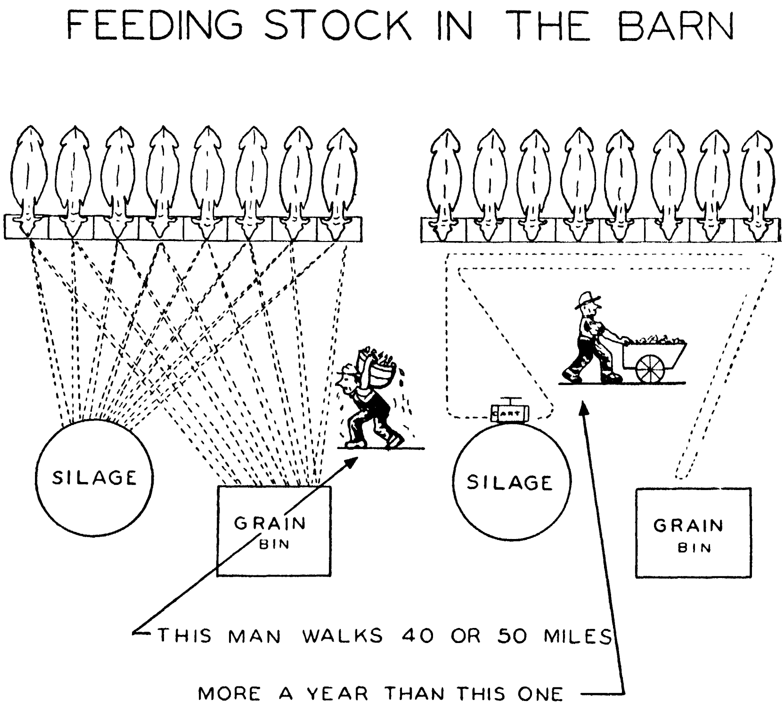
Practices Followed	*Number of Farms*	RETURNS ABOVE FEED COST *Per Cow*	*Per 100 Lb. Hogs. Produced*	*Per 100 Hens*
	Dairy enterprise (12 practices)			
6 or less	12	$67	....	....
7–9	50	72	....	....
10–12	59	87	....	....
	Hog enterprise (10 practices)			
4 or less	54	....	$2.20	....
5–7	57	....	2.54	....
8–10	17	....	3.92	....
	Poultry enterprise (10 practices)			
4 or less	28	....	....	$114
5–7	65	....	....	186
8–10	53	...	....	252

Source: Minnesota Bulletin 288, "Relation of Variations in the Human Factor to Financial Returns in Farming," by W. W. Wilcox, Andrew Boss, and George A. Pond, p. 27.

portant and when followed add appreciably to the net income of the farm.

2. The Effect of Methods on Utilization of Labor

Among the factors of production most adapted to the application of improved methods, labor is perhaps the most significant. A classic example of how methods used in performing tasks may affect the amount of labor used is found in the harvesting of corn. There are four common methods used in harvesting this crop: (a) picking by hand from the field, (b) picking by hand from the shock, (c) husking and shredding from the shock, and (d) using a corn picker.


FEEDING STOCK IN THE BARN
SILAGE
GRAIN BIN
CART
SILAGE
GRAIN BIN
THIS MAN WALKS 40 OR 50 MILES
MORE A YEAR THAN THIS ONE

Courtesy of Sinclair Refining Co.

Fig. 24. One way to reduce the use of labor is to redevise the method of doing farm tasks.

Moorhouse and Juve[2] in an investigation into the labor material requirements for producing field crops found that on the average, corn harvesting from the standing crop required 6.3 hours of man labor per acre, while the time required to harvest corn from the shock was 31.7 hours of man labor per acre, or approximately 5 times that required to harvest it from the field.

A careful study of this problem was made by Zintheo[3] in which he found that of four methods of harvesting corn the use of a corn binder was the most effective in economizing labor. When the corn was picked from the standing stalk in the field, one man harvested 1.47 acres per day, or at the rate of 6.8 hours of man labor per acre.[4] Harvesting the corn from the standing shock required 4.28 hours of man labor per acre, or 2.5 hours less than that required by the first method. When machinery was employed, as in the case of the corn binder and corn shocker, man labor requirements were greatly reduced. In the case of the corn binder, only 1.3 hours of man labor were required per acre, while in the case of the corn shocker 2.14 hours of man labor were required. (See Table 62.)

In some parts of the Cotton Belt several methods of harvesting cotton are available to the growers. This is true in Texas and Oklahoma. In these states the farm operator may pick the cotton from the open bolls by hand, a method used almost exclusively in the Eastern states, and snap the immature bolls from the plant, or he may use some mechanical device, such as the sled or the mechanical picker. These methods are commonly known as picking, snapping, sledding, and mechanical picking. Brodell and Cooper[5] found that the average time required to pick by hand enough seed cotton to make a 500-pound bale varied from an average of

---

[2] Moorhouse and Juve, "Labor and Material Requirements for Field Crops."

[3] Zintheo, "Corn Harvesting Machinery."

[4] This is assuming a 10-hour day.

[5] Brodell and Cooper, "Requirements and Cost for Picking, Snapping, and Sledding Cotton in Western Texas and Oklahoma."

TABLE 62

DIFFERENCES IN LABOR USED PER ACRE IN HARVESTING CORN ACCORDING TO FOUR DIFFERENT METHODS[a]

Methods Used	*Acres Harvested*	*Man Labor Hours*	*Man Hours per Acre*	*Differences in Labor Used per Acre over First Method*
By hand from standing stock	1.47	10	6.8	....
Harvesting by use of sled	4.67	20	4.28	2.52
Corn shocker	4.67	10	2.14	4.66
Corn binder	7.73	10	1.3	5.5

[a] Zintheo, "Corn Harvesting Machinery."

48.7 hours in Lubbock, Texas, to 80.4 hours in Stillwater, Oklahoma. On the other hand, the time required to obtain enough seed cotton to make a 500-pound bale by snapping varied from 33.7 hours in Lubbock to 55.1 hours in Stillwater. In the case of sledding it required only 5.3 hours of man labor to pick enough seed cotton to make a 500-pound bale in Lubbock and 8.5 hours in Hobart, Oklahoma. Sledding, as a method of harvesting cotton, reduced the labor requirements approximately 90 per cent.[6]

The reduction in the labor required to harvest seed cotton should not be used as the sole basis in determining which of the three methods should be employed. There are several other things that must be considered: the ginning cost is much greater when cotton is snapped and sledded than when it is picked by hand. The reason for this is that the cotton must be specially treated before it can be ginned when it is snapped or sledded. In spite of this fact, however, the total cost including both the ginning and harvesting was much less in the case of sledded cotton than in either of the other two methods employed. The data do not show the loss in the value of the cotton due to the reduction in the grade and staple of the cotton which was sledded and snapped. Although accurate information is not available as to the extent to which cotton is reduced in quality when it is snapped or sledded, reliable estimates place the loss at approximately 12 per cent.

---

[6] Cotton is now harvested by a cotton picker in some parts of the South. The labor per bale is about one-fifth or less of the cost of picking by hand.

Much labor can be saved and tasks made easier by the rearrangement of buildings and by substituting a new method for an old one. An excellent example of this saving is found in a bulletin by R. M. Carter.[7] Carter studied a number of dairy farms in Vermont for the purpose of determining accurately just how dairy farmers did their "dairy barn chores." One of the important parts of this investigation was that relating to labor saved in feeding cows. It was found the time used in feeding could be reduced, and the work made easier, by the simple and inexpensive expedient of substituting a cart for a basket in feeding the cows. In a specific case, when this device was used, together with certain changes in the arrangement of the stable, the distance traveled in feeding and caring for the cows was reduced from 884 feet daily to 293 feet.[8] (Figure 24.)

3. The Effects of Methods on the Utilization of Capital

The methods used in doing farm tasks also affect the use of capital goods, such as seed, fertilizer, feed, and spray materials. Seed can be made much more effective, not only by using more seed but by using the seed in definite ways, such as spacing the seed (or plants) in the row, adjusting the type of seed to the soil conditions, adjusting the distance between rows in accordance with conditions of soil and moisture, planting at the proper depth, and in numerous other ways. The efficient use of feed also depends on the methods used. For example, rations may be adjusted to the nature of the product being produced or, as in the case of workstock, to the nature of work to be done. Fertilizer can be used more efficiently by employing certain methods of distributing it in the rows or by adjusting the mixture to the type of crop being produced. It is well known that the kind and type of spray material used, as well as the time and methods of applying materials, have a direct relation to the quality and quantity of the crops produced.

---

[7] Carter, R. M., "Labor Saving Through Farm Job Analysis: 1. Dairy Barn Chores," Vermont Experiment Station Bul. 503, June, 1943.

[8] Ibid., p. 35.

It is not necessary to cite at length data that are available showing the relationship between the methods employed and the utilization of capital. In a series of experiments conducted by the North Carolina Agricultural Experiment Station in coöperation with the National Fertilizer Association, Collins[9] found that the placement of fertilizer in the rows had considerable effect on production. When the fertilizer was placed in bands 1.5 inches on each side of the plants and 1 inch below the seed level, 1,694 pounds of seed cotton to the acre were harvested. When the bands were 3.5 inches on each side of the plant and 1

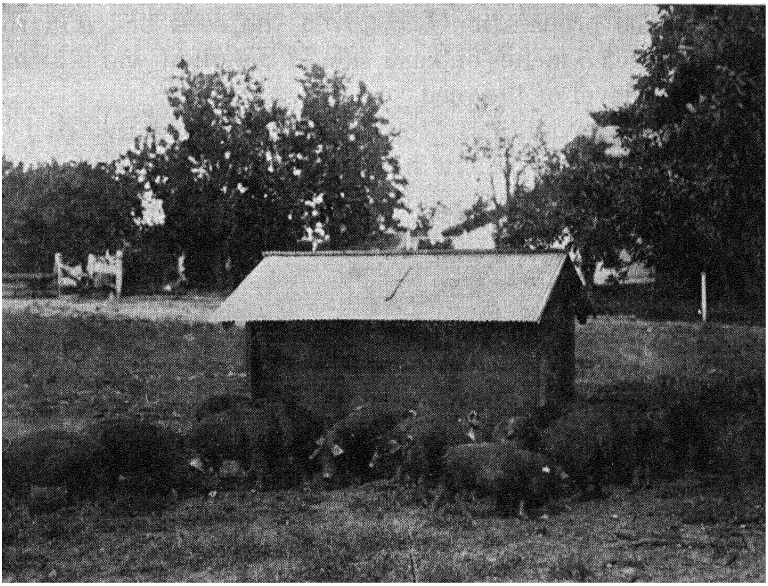


Illustration from Bu. of Agr. Econ.

Fig. 25. Self-feeders economize both feed and labor.

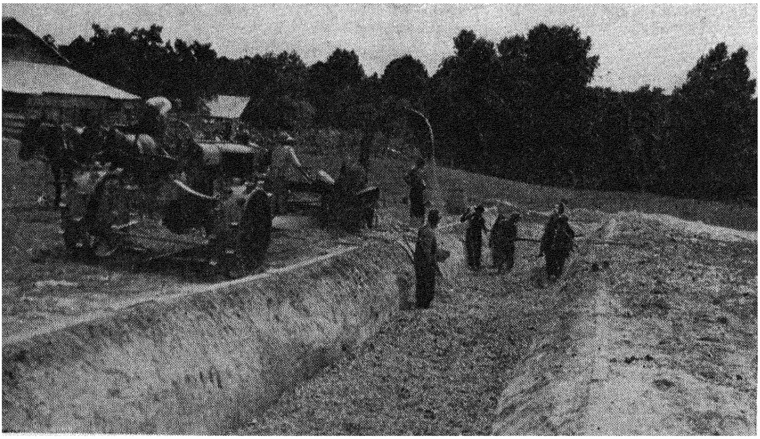
---

[9] Collins, "Instruction on the Mechanical Application of Fertilizer for Cotton in North Carolina, with Some Results from Other Crops Obtained in the State."

inch below the seed level, the production was 1,672 pounds. Finally, when the bands were 1.5 inches on each side of the plant and placed 2 inches below the seed level, production was 1,610 pounds.

A more striking difference in production was obtained when the land was bedded in advance of planting. The bands were 2.5 inches on each side, and the fertilizer was applied 3 inches below the seed level. In this case 1,347 pounds were produced as compared with 1,056 pounds when no advance preparation was given the seed bed and the bands were 2.5 inches on each side of the plant and 2 inches below the level of the seed.

Ezekiel, McNall, and Morrison [10] found that the kind of rations fed to dairy cattle had a material effect on the flow of milk. When a ration having a narrow nutritive ratio was used, the milk production was higher than when the ration having a wide nutritive ratio was fed. When the nutritive



Courtesy of N. C. State Dept. of Agr.

Fig. 26. A trench silo is a cheap method of storing silage and is justified under some conditions.

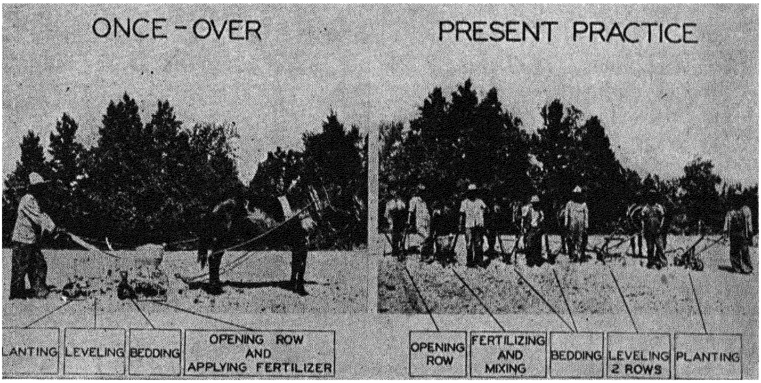
---

[10] Ezekiel, McNall, and Morrison, "Practices Responsible for Variations in Physical Requirements and Economic Costs of Milk Production on Wisconsin Dairy Farms," p. 27.

ratio was 1:11.5, the milk flow was 82.3 per cent of what might be expected from an average ration, while for a ration having a nutritive ratio of 1:7.0, the milk production was 111.7 per cent of what might be expected, or the narrow nutritive ratio increased the milk production 36 per cent over a ration having a wide nutritive ratio.

4. The Relation of Methods to the Use of Land

Land may be made to produce more simply by the farmer's selecting and using the proper methods of cultivation. Without any increase in the other factors of production—such as fertilizer or seed or amount of labor used—some methods of cultivation will produce higher yields than others. To some extent, the increase in yields may not be the result solely of the methods used. For example, to plow 7 inches deep will require the use of more labor and the expenditure of more capital than to plow 4 inches deep. In the main, however, the increase in yield is traceable to the method used rather than to any increase in the factors of production.



Courtesy of N. C. Agr. Experiment Station

Fig. 27. By substituting new for old methods of doing specific farm tasks both capital and labor can be economized.

In a three-year experiment Mosier and Gustafson[11] found that the method used in cultivating corn had a marked effect on yields. The higher yields were obtained when the roots were unpruned and the cultivation was shallow, and the lowest yields were obtained when the roots were pruned with a knife and the weeds were scraped off with a hoe. When the corn was cultivated 4 or 5 times, the shallow cultivation gave 8.4 bushels per acre more than deep cultivation.

---

[11] Mosier and Gustafson, "Soil Moisture and Tillage of Corn."

TABLE 63

EFFECT OF DEPTH OF PLOWING ON THE YIELD OF WHEAT[a]

Treatment of the Land	*Average Yield per Acre (Bushels)*
Disked at seeding time	6.8
Disked July 15, plowed September 15, 7″ deep	17.5
Disked July 15, plowed August 5, 7″ deep	18.2
Listed July 15, ridges worked down	17.5
Listed July 15, ridges split August 15	17.4
Plowed July 15, 7″ deep	20.8
Plowed August 15, 7″ deep, worked immediately	19.5
Plowed August 15, 7″ deep, not worked until September 15	18.1
Plowed September 15, 7″ deep	13.5
Plowed July 15, 3″ deep	16.4

[a] Sewell, *Journal of American Society of Agronomy*, Vol. II, pp. 269-290.

The depth of plowing is important in the production of some crops, especially in areas where the rainfall is limited. In the experiment conducted in Kansas by Sewell[12] for a period of 8 years, the highest average yields of wheat were obtained when the land was disked July 15 and plowed 7 inches deep. This was true irrespective of when the land was plowed, whether as of July 15 or August 15, although the earlier plowing gave somewhat better results. (See Table 63.)

5. Time or Timeliness as Related to Farm Practices

There are several factors to be considered regarding the element of time in farm practices. In the first place, there is for every operation under a given set of natural conditions, an optimum time of performance—that is, optimum in regard to yields. Knowledge of the best time to do things should be a part of the farmer's technical equipment, and, other things being equal, maximum yields should be his goal in production. It is also true that a given time may be best for a given operation on one crop, and the same time may be best for another operation on some other crop. That is, practices often conflict. Another factor to be considered is the seasonal variation in prices. This may be very important in such cases as the freshening of dairy cattle or the breeding of hogs. Even though breeding at one time may result in a higher output, prices may be higher at some other season than that in which the produce would be marketed. In such cases, the relative value of the product will determine the economical practices; that is, the lower production sold at higher prices may be more valuable than the larger amount sold at lower prices.

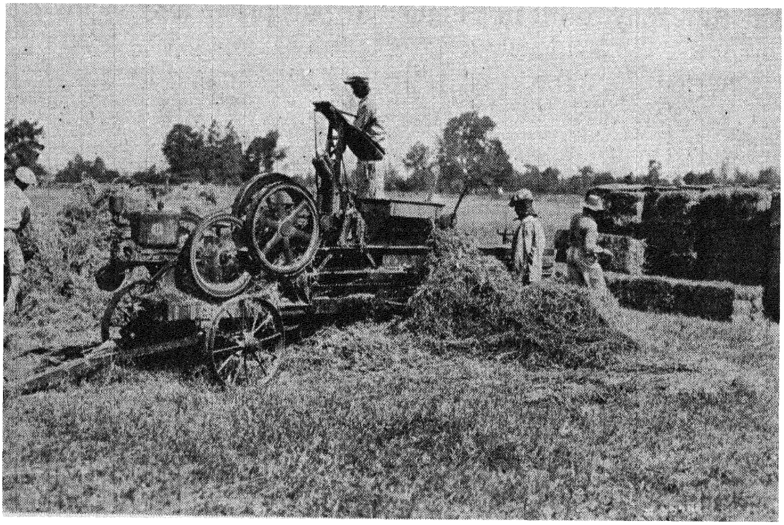
---

[12] Sewell, "Tillage," pp. 269-290.

Courtesy of the International Harvester Co.

Fig. 28. When a task must be done quickly, a tractor may be indispensable.

An excellent illustration of the importance of timeliness is furnished by a study of hog production made by Elliott in Illinois.[13] Elliott points out that the most successful farmers adjust their time of breeding as well as their time of selling to prospective market conditions. One successful farmer plans to have his sows farrow early in March in years in which the price of hogs is comparatively high at time of breeding but is expected to slump considerably in the following fall. "The pigs are pushed as rapidly as possible and got on the market the latter part of August or early September. Thus he tries to get ahead of the big rush of spring litters that starts in October and continues through the winter months." Another farmer "regulates his production and marketing so as to sell on the high seasonal markets. He has part of his sows farrow in March and others farrow a month or so later. The March pigs are sold



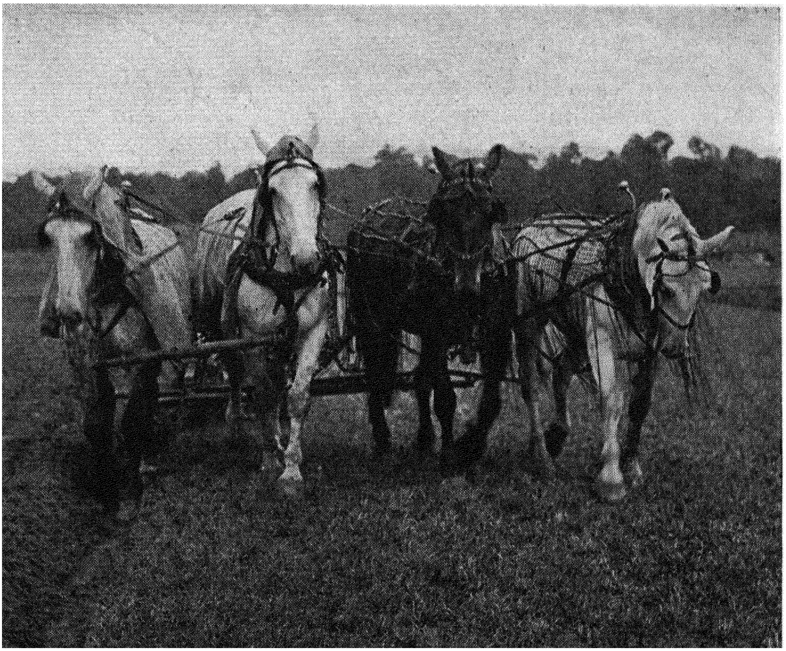
Courtesy of the International Harvester Co.

Fig. 29. When storage space is limited, it is a good practice to bale the hay and straw.

---

[13] Illinois Agricultural Experiment Station, "Adjusting Hog Production to Market Demand."

at 6 months of age on the following September market, and the May pigs are sold the following March and April at 11 months of age. . . . The fall pigs are usually farrowed in August or September and are sold either the next April or July and August, when they weigh around 300 pounds. The time of selling the fall pigs varies with the market situation and with the price of corn. If the price of corn is comparatively high, he sells at lighter weights in April, but, if corn is cheap and hog prices favorable, he feeds longer and sells in either July or August, depending upon the market at the time."

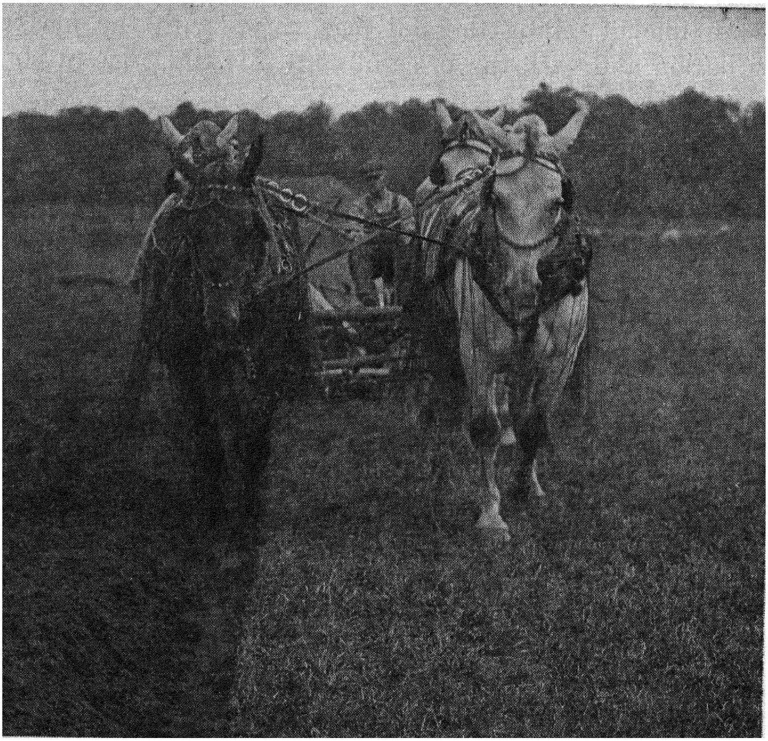


Courtesy of Horse and Mule Ass'n of America.

Fig. 30. Horse power may be used more effectively if the proper hitch is used. Note the strained position of the nigh horses. Compare with Fig. 31.

In these cases the increase in price must be compared with the loss of pigs resulting from farrowing in bad weather and also with the additional cost of rapid fattening. The practice of feeding out to heavier weights than usual in order to hit the market at a better time involves different amounts of input factors as well as the element of time.

The time to have dairy cows freshen is an important consideration with many dairy farmers. In a study made in Chester County, Pennsylvania, it was found that cows freshened in the fall, other things being equal, produced one eighth more milk during the year than those freshened in the spring.[14] A study in Wisconsin, however, shows that no



Courtesy of Horse and Mule Ass'n of of America.

Fig. 31. The efficiency of the horses is increased and depreciation decreased if the proper hitch is used. Note the easy position of the horses in this figure as compared to the strained position in Fig. 30.

---

[14] Ezekiel, "Studies of the Effectiveness of Individual Farm Enterprises," p 92.

particular significance can be attached to the time of freshening as practiced among 95 farmers.[15]

It should be clear from the foregoing discussion that farm practices are the basis of efficiency in the production program. The farm manager, in order to direct the farm in the most efficient manner, must know and select the right practices and must change practices from time to time as new methods are developed, as marketing conditions change, or as the relationships between prices and costs change. Through the press and through the educational extension program the results of valuable research in farm practices are made available to farmers. In almost every case, however, the farmer, in view of his own conditions, must decide whether a given practice can be used on his farm and whether or not by its use he can increase efficiency in production and thus increase the returns from the farm.[16]

Questions

1. State the possibilities of increasing the farm income by the adoption of better methods of performing farm tasks.

2. Give instances in which specific tasks increased farm income.

3. Discuss the effectiveness of the application of various methods to harvesting of corn.

4. How may the productivity of capital be increased by approved practices?

5. How important is timeliness in farm operations? Illustrate your answer.

References

Adams, R. L., *Farm Management.* New York: McGraw-Hill, 1921, Chapter XIII.

Ezekiel, M. J. B., "Studies of the Effectiveness of Individual Farm Enterprises," *Journal of Farm Economics,* Vol. VIII, No. 1, p. 92.

Holmes, C. L., *Economics of Farm Organization and Management.* Boston: Heath, 1928, Chapter XX.

Sewell, M. C., "Tillage," *Journal of American Society of Agronomy,* Vol. XI, pp. 269–290.

---

[15] Wilcox, Boss, and Pond, *op. cit.,* p. 32.

[16] Holmes, *Economics of Farm Organization and Management,* Chapter XX.

Illinois Experiment Station Bulletin 293, "Adjusting Hog Production to Market Demand," by F. F. Elliott.

Illinois Experiment Station Bulletin 181, "Soil Moisture and Tillage of Corn," J. G. Mosier and A. F. Gustafson.

Minnesota Experiment Station Bulletin 288, "Relation of Variations in the Human Factors to Financial Returns in Farming," by Walter W. Wilcox, Andrew Boss, and George A. Pond, 1932.

North Carolina Experiment Station, *Agronomy Information Circular 104,* "Instruction on the Mechanical Application of Fertilizer for Cotton in North Carolina, with Some Results from Other Crops Obtained in the State," by Emerson R. Collins.

U. S. Department of Agriculture, *Department Bulletin 1000,* "Labor Requirements for Field Crops," by L. A. Moorhouse and O. A. Juve.

U. S. Department of Agriculture, *Farmers' Bulletin 1525,* "Effective Haying Equipment and Practices," by L. A. Reynoldson.

U. S. Department of Agriculture, *Bulletin 173,* "Corn Harvesting Machinery," by C. J. Zintheo.

U. S. Department of Agriculture, "Requirements and Costs for Picking, Snapping, and Sledding Cotton in Western Texas and Oklahoma," by A. P. Brodell and M. R. Cooper, June, 1927.

Wisconsin Experiment Station Research Bulletin 79, "Practices Responsible for Variations in Physical Requirements and Economic Costs of Milk Production on Wisconsin Dairy Farms," by M. J. B. Ezekiel, P. E. McNall, and F. B. Morrison.

CHAPTER XIV

Farm Layout

THE purpose of studying this subject is to determine how, and to what extent, the farm may be arranged so as to effect the maximum utilization of the several factors of production. In considering the problem of farm layout from this point of view, the fact that the farm is, in most instances, not only a place of business but also the home of the farmer should be held in mind. A good farm layout, therefore, should provide for the most efficient use of the factors of production and for a convenient and attractive home. These two objectives may be at times in conflict with each other. It is not always possible to have the farmstead located and organized in such a manner as to be at one and the same time attractive and convenient in the administration of the farm. When these two objectives are in conflict, the farm manager should attempt to provide the maximum attractiveness with minimum inconvenience in the administration of the farm. Most farmers give too little attention to the farm layout, with the general result that the farm is too often neither attractive in appearance nor convenient in operation.

1. Factors Affecting the Farm Layout

The factors affecting the farm layout are so numerous that it is seldom, if ever, possible to lay out a farm in an ideal way. Topography is the most disturbing element. The presence of hills and valleys often makes it difficult to secure uniformity in the size and shape of the fields. Topography not only affects the size and shape of the field but is a factor determining the location of the farmstead. Normally, the farmstead should be located on high and well-drained ground. The topography may be of such a character, however, that, if the farmstead is located on the best building site, it may not be in the best place from the standpoint of farm operations. For example, the best site for the farmstead from the standpoint of topography might be in one corner of the farm farthest from the highway. Obviously, such location would not be most convenient from the standpoint of farm operation. Thus, it may happen that the farmer in selecting a place for his farmstead will be compelled to make a compromise between a site which is best from the standpoint of topography and one which is ideal from the standpoint of operating the farm.

The distribution of the soil types may be such as to prevent the developing of a good farm layout. It is always best to have each field uniform as to soil type. The reason for this is of course obvious. In order for the best tillage practices and power machinery in harvesting to be used and in order for each crop to be adapted to the soil best suited for it, the soil in any given field should be uniform. Where soil types are numerous, it is often difficult to have the fields uniform as to size and shape and at the same time to have each field contain but one soil type. In some instances it may be more important to have fields uniform as to soil type rather than to have a good farm layout.

There are other factors that may also affect the layout of the farm. Access to water, especially when livestock is an important element of the farm business, often affects the farm layout. Fields intended for pastures should have water in them. It may happen that if the fields are to have water in them, they cannot be made uniform in either shape or size. Finally, highways, railways, and canals may cut the farm at such angles as to make uniformity of size or shape of fields impossible. Such are some of the important factors which the farm manager may encounter when he attempts to improve the farm layout. As a rule, uniformity in size and shape of fields as well as the location of the farmstead must yield in some degree to these various factors. Hence, it is, as a rule, impossible to have an ideal farm layout.

2. The Ideal Farm Layout

For the reasons already given, an ideal layout is not often possible. However, the importance of a good farm layout may best be indicated by a discussion of the ideal. An ideal farm layout is usually described as one having the fields of uniform size and shape and the farmstead so located that the distance from the farmstead to the center of the fields is a minimum. This description is not quite adequate. The cost of operating the farm is influenced by other factors than the distance from the farmstead to the fields. The distance of the farmstead to the public highway is one of these factors. It may be more important, from the standpoint of the cost of operating the farm, to have the farmstead near the public highway. It has been suggested, therefore, that in an ideal layout a public highway should bisect the farm, with the farmstead near the highway and in the center of the farm.[1] This arrangement, it is argued, will give the minimum distance from the farmstead to the fields and secure the advantages of being located on the highway. (See Figure 32.)

In discussing this phase of the subject of farm layout, the general objective should not be lost sight of. The objective is to secure the best utilization of all the factors of production insofar as the utilization is affected by the farm layout. A farm layout which is ideal from the standpoint of the distance from the farmstead to the center of the fields or with respect to the location of the farmstead on the highway may not be the best layout when other factors are considered. When the highway cuts through the center of the farm, it will entail, as a rule, additional fencing. Furthermore, the presence of a fence on both sides of the highway means an additional loss of land. Another factor is the killing or injuring of livestock by automobiles, trucks, or busses, when the farm is located on the highway. Taxes will probably be higher, especially when an improved public highway cuts through the farm.

---

[1] Warren, *Farm Management*, p. 570.

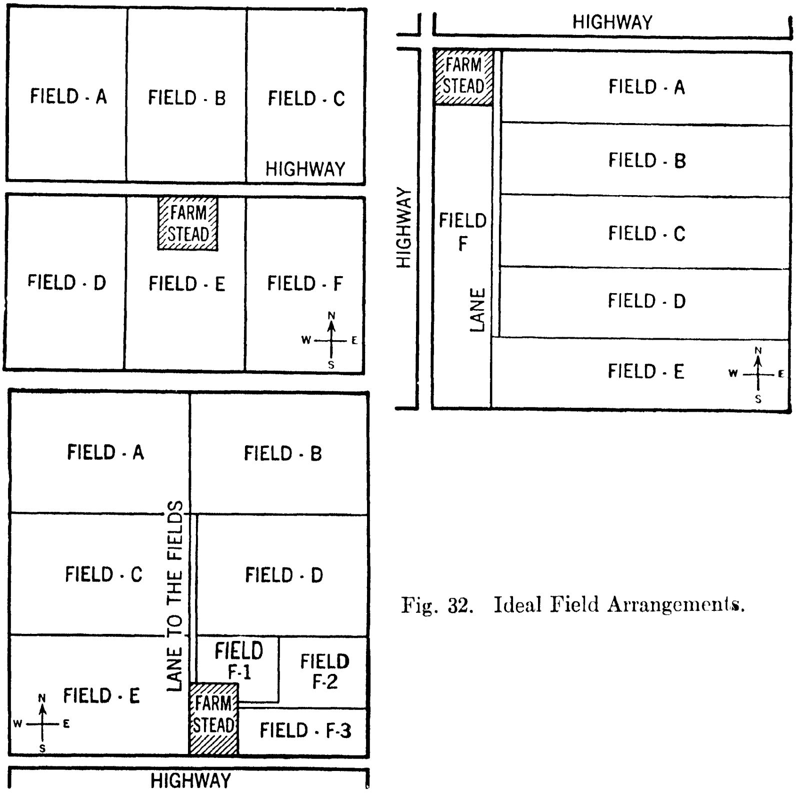


Fig. 32. Ideal Field Arrangements.

3. The Effect of Farm Layout on the Use of Factors of Production

As the chief elements of the farm layout are the shape, size, number, and arrangement of the fields and the location and arrangement of the farm buildings, some attempts have been made to state the effect of each of these elements on the utilization of the factors of production. However, this is an impossible task. Some of the elements such as size and shape tend to have the same general influence on the utilization of the factors of production. It is impossible from data available to determine the net effect of one of these factors independently of the others. That is to say, the exact influence of the size of the fields, for example, cannot be determined independently of the shape, or the influence of the shape independently of the size. Hence, in the following discussion this limitation of the data should be constantly held in mind.

a. *Land.* The first factor that is affected by the farm layout is land. Small, irregularly shaped fields increase the amount of waste land or land that is not cultivatable. That is to say, in small, irregularly shaped fields the per cent of the total area that will normally be in the corners and along the sides of the field is larger than is the case where the fields are large and regular in shape. Or, as the fields increase in size and become more regular in shape, the per cent of the total area lost to cultivation declines. Although the per cent lost to cultivation declines, the absolute amount increases.

The per cent of the total area lost to cultivation because of the size and shape of fields is affected by the implements employed. Where small-powered machinery or hand implements are used, the loss need not be very great, but where large power-drawn machinery is used, the percentage of the total area lost, in the case of small fields, is large. Similarly, the type of fences used, irrespective of the shape and size of the field, affects the amount of land which can in fact be cultivated. A smooth wire fence will permit the cultiva-

TABLE 64

Relation of Kind of Fence to Land Occupied By Fences[a]

Kind of Fence	Width of Land Made Untillable (One side of fence only) (Feet)	Rods of Fence Necessary to Occupy an Acre of Land
Smooth wire	3.0	871
Board fence	3.0	871
Woven wire	3.1	852
Barbed wire	3.3	793
Straight rail	3.6	733
Worm rail	6.4	411
Laid stone fence	4.9	539
Brush	9.4	282
Hedge	9.6	276

---

[a] Cornell University Agricultural Experiment Station, *Memoir 34*.

tion of more land than will, for example, a stone fence or a worm fence. Hedges prevent even to a larger extent than a worm fence the cultivation of land. This fact is borne out by the data presented in Table 64.

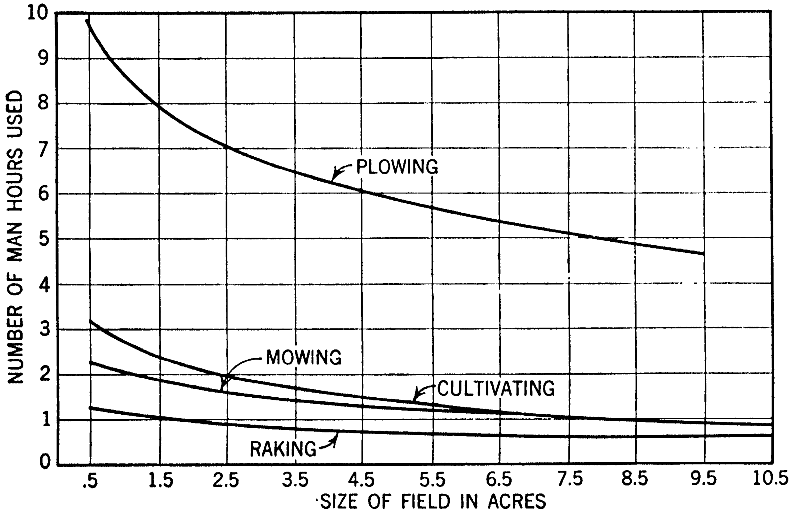


Fig. 33. The amount of labor used on some farm tasks is greatly affected by the size of the fields.

Another point which should not be overlooked in any attempt to utilize land to a better advantage is artificial or natural obstructions. Stone piles are often left either in the field or along the fences. In either case, these piles of stone occupy valuable crop land, that is, land which might be producing income. Not infrequently stumps are left in the ground when the removal cost is much less than the annual income lost by the land they occupy. Hedgerows often occupy valuable crop land. If hedgerows are used for landscaping, they should be kept neatly trimmed and as narrow as possible, but when not needed for this purpose they should be removed. Finally, sink holes or wet damp spots in the field may often be removed either by drainage or by filling in with dirt, stones, or other debris. These obstacles should be removed when labor cannot be more efficiently used in the operation of the farm. The removal of such spots will not only add land to the farm but will often make it possible to utilize more efficiently labor and machinery. Their removal will also tend to give the field a more attractive appearance.

b. *Labor.* On most farms, labor is the factor which is most affected by the farm layout. In using labor the two most important elements of the layout are size and shape of fields. The importance of these two elements depends upon the nature of the operation and the type of equipment employed. For example, it is more important to have large fields for plowing than for mowing. (See Tables 65, 66, and 67.) Furthermore, as the size of the team driven increases, the size of the field, as an element in the utilization of labor, becomes more important. When tractors are used instead of horses, the size and the shape of the fields become still more important. It should be pointed out, however, that modern machinery, especially tractors, even when large, may require less turning space than horse-drawn equipment. This is especially true when the equipment, such as plows or cultivators, is slung under the tractor. (See Chap. XVII, Sec. 3.)

TABLE 65

RELATION OF SIZE OF FIELDS TO LABOR REQUIRED TO MOW AN ACRE[a]

Size of Fields (Acres)	*Number of Fields*	*Average Size of Fields (Acres)*	*Average Length of Fields (Rods)*	*Time Required to Mow One Acre*	
				Man Hours	*Horse Hours*
Less than 2	11	1.54	28.5	1.3	2.6
2–4.9	21	3.35	37.6	1.2	2.4
5–9.9	11	7.08	46.2	1.0	2.0
10 or more	7	15.73	61.4	1.0	2.0
Total	50	....	....	...	...
Average	..	5.50	40.8	1.1	2.2

[a] Cornell University Agricultural Experiment Station, *Memoir 34.*

TABLE 66

RELATION OF SIZE OF FIELDS TO LABOR REQUIRED TO PLOW AN ACRE[a]

Size of Fields (Acres)	*Number of Fields*	*Average Size of Fields (Acres)*	*Average Length of Fields (Rods)*	*Time Required to Plow One Acre*	
				Man Hours	*Horse Hours*
Less than 2	40	1.02	20.6	8.5	19.8
2–4.9	57	3.48	34.6	6.5	15.0
5–9.9	78	7.24	49.9	6.2	16.2
10–14.9	40	11.68	54.7	5.7	14.3
15 or more	27	20.26	77.9	5.1	13.2
Total	242	....	....	...	....
Average	...	7.51	45.4	5.8	14.8

[a] Cornell University Agricultural Experiment Station, *Memoir 34.*

Labor may be used more efficiently if the fields are so arranged that the distance between them and the farmstead is reduced to a minimum. As Myers[2] has pointed out, the labor saved by an effective field arrangement depends upon the type of rotation followed. The more intensive the rotation, the greater the opportunity for reducing the amount of labor used in going to and from the fields. For example, under New York farming conditions a 5-year rotation of silage, corn, oats, wheat, and hay requires as a minimum 6 man and 14 horse trips per acre per year. If, as Myers has assumed, the time required for these trips is 2 hours per man labor and 4.5 hours per horse labor, and assuming further that the man labor is worth 30 cents, and horse labor 20 cents per hour, then the total cost per acre per year for these trips would be $1.50. As $1.50 is equivalent to $25 at 6 per cent per annum, Myers concluded that a field located adjacent to the farmstead is worth $25 more per acre than a field ½ mile from the farmstead. Although these calculations exaggerate the importance of arrangement of the field with respect to the farmstead, it is, nevertheless, true that arrangement is important. The better this arrangement, the more valuable the farm, because of the labor saved in going to and from the fields.

---

[2] Myers, "An Economic Study of Farm Layout."

TABLE 67

RELATION OF LENGTH OF ROW TO PROPORTION OF TIME TAKEN TO TURN [a]

Length of row (rods)	10	20	40	60	80	100	120
Time on row [b] (minutes)	1	2	4	6	8	10	12
Time for turning [c] (minutes)	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Proportion of time used for turning	1/3	1/5	1/9	1/13	1/17	1/21	1/25

---

[a] Spillman, *Farm Management*, p. 289.
[b] Assuming 10 rods per minute (1.875 mi. per hr.) as average rate of speed.
[c] Assuming ½ minute taken for each turn.

c. *Capital.* The shape and the size of the fields affect also the utilization of capital. Large rectangular fields are better suited for the use of modern farm machinery than small multisided fields. Tractors, as a rule, cannot be used efficiently on small, poorly shaped fields. The same is true of horse-drawn machinery. When the fields are small, one-

and two-horse teams must be used. If the fields are large, four- and six-horse teams may be employed, and the cost of operation may be materially reduced. Of course, the importance of the size and shape of the fields as a factor in the utilization of capital will vary with the agricultural area. In many parts of the South modern machinery is not commonly employed, and one or two mules is the common power unit. In such areas, the size and shape are not so important as in some parts of the West, where modern machinery is employed and three-, four-, or six-horse teams are used.

TABLE 68

RODS OF FENCE PER ACRE REQUIRED FOR A SQUARE FIELD[a]

Area of Field (Acres)	*Rods of Fence to Enclose Field*	*Rods of Fence per Acre Enclosed*
1	50.6	50.6
5	113.2	22.6
10	160.0	16.0
20	226.4	11.3
40	320.0	8.0
80	452.6	5.6
160	640.0	4.0
640	1,280.0	2.0

---

[a] Spillman, *op. cit.*, p. 286.

The shape and the size of the field affect the cost of fencing. A large field will, of course, cost more to fence than a small one. But the cost per acre decreases as the size of the field increases. Table 68 shows how the size of the field is related to the number of rods of fence required for a square field. A field of 1 acre will require 50.6 rods of fencing. And while the number of rods increases as the size of the field increases from 50.6 in the case of a 1-acre field to 1,280 for a field of 640 acres, the rods per acre decrease from 50.6 for the 1-acre field to 2 rods for the 640-acre field. The quality of the fence being the same, it is obvious that the cost per acre for fencing decreases rapidly with the increase in the size of the field.

The shape as well as the size affects the cost of fencing. A square field can be fenced more economically than an oblong field. This is indicated by the data in Table 69. As the field gets larger and narrower, the number of rods of fence required increases markedly. For a field 80 rods square, 320 rods of fence are needed. But for a field 10 rods wide and 640 rods long, 1,300 rods are required. Of the various shaped fields of a given area, the circular field requires the smallest number of rods of fence. A circular field, however, is not practical.

TABLE 69

RODS OF FENCE REQUIRED FOR A 40-ACRE FIELD HAVING DIFFERENT LENGTHS

Width of Field	*Perimeter*	*Rods per Acre*
80	320	8
40	400	10
20	680	34
10	1,300	130

4. Planning the Farm Layout

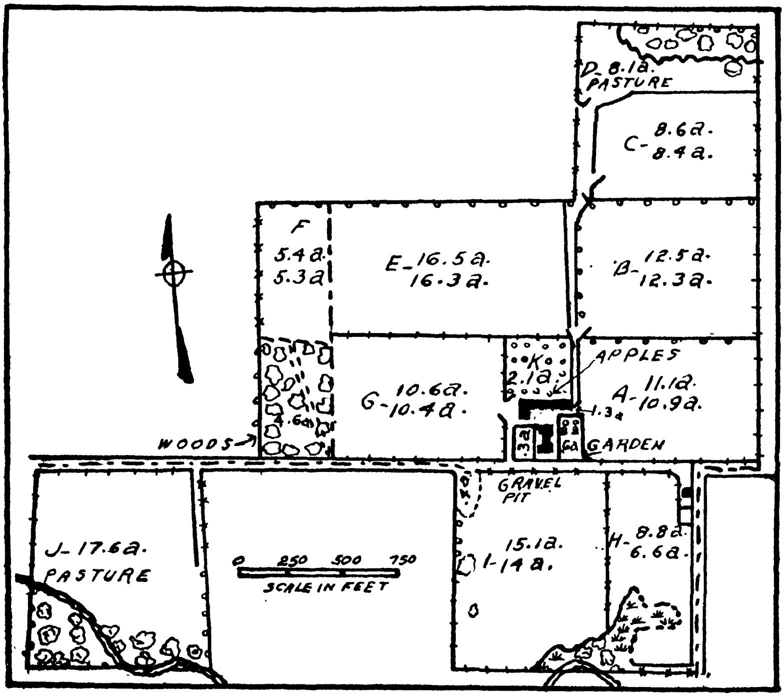
How can a good farm layout be obtained? Myers suggests the following procedure: [3]

> The first step in planning a rearrangement is to study the farm and the conditions surrounding it. For this purpose it is well to have a map of the farm. This need not be an engineer's map, accurately drawn to scale; a rough plan showing the relative sizes, shapes, and locations of the various fields will serve. . . . In addition to the map, it is necessary to have a thorough knowledge of the soil and drainage conditions, and of the topography of the different parts of the farm.
>
> The second step . . . is to decide on the cropping plan or rotation that is to be followed. While it is not possible to follow a rigid crop rotation on most farms, it is advisable to follow a fairly definite cropping plan. Knowing the crops that are to be grown, the acreage needed for each, and the crop area, a cropping plan can be made which will satisfy these requirements. If two rotations are followed, two sets of fields, perhaps of different sizes, will be required.
>
> After studying the farm and deciding on the system of farming and the crop rotation to be followed, plans should be made for the long-time development of the farm which will provide as good a layout as the

---

[3] Myers, *op. cit.*

natural limitations will permit. The plans should be developed slowly and the work should be done at odd times. The savings to be made are seldom large enough to pay the entire cost in one year. If properly planned, such work helps in the labor distribution by keeping the men profitably employed when there is little other work to be done. Small fields can gradually be combined into larger units without radical changes in the rotation. It is usually unnecessary and unwise to plow up a good new seeding in order to combine two fields; the same results might be accomplished in a year or two by repeating a crop on one of the fields, or by leaving down a piece of hay for another year.



From W. I. Myers, Cornell University Agr. Exp. Sta. Memoir 34.

Fig. 34. The Layout of a Central New York Farm.

5. Developing a Good Farm Layout

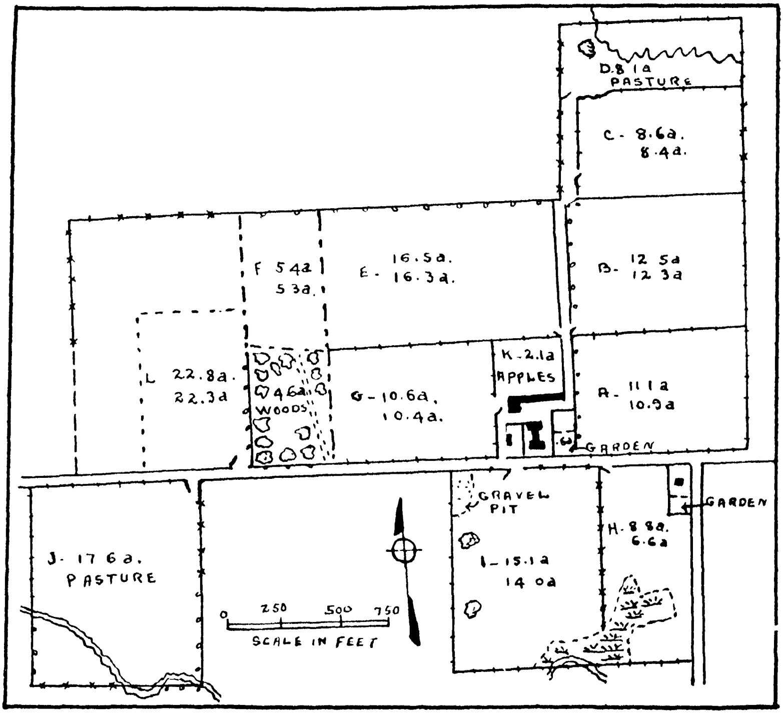
A classic example of how a good farm layout may be developed is described by Myers in his economic study of farm layout.[4] The farm described is located in central New

---

[4] Myers, *op. cit.*, p. 538.

York. This farm consists of 126 acres. The topography, although rolling, is quite well adapted to the use of machinery. The major crops in the system of farming were corn for silage, corn for grain, Irish potatoes, oats, wheat, and hay. In addition to these crops, milk was produced for sale. The soil is light in texture but in spite of this produces good yields of grain and hay. A four-year rotation of (1) corn and potatoes, (2) oats, (3) wheat, and (4) hay was followed generally.

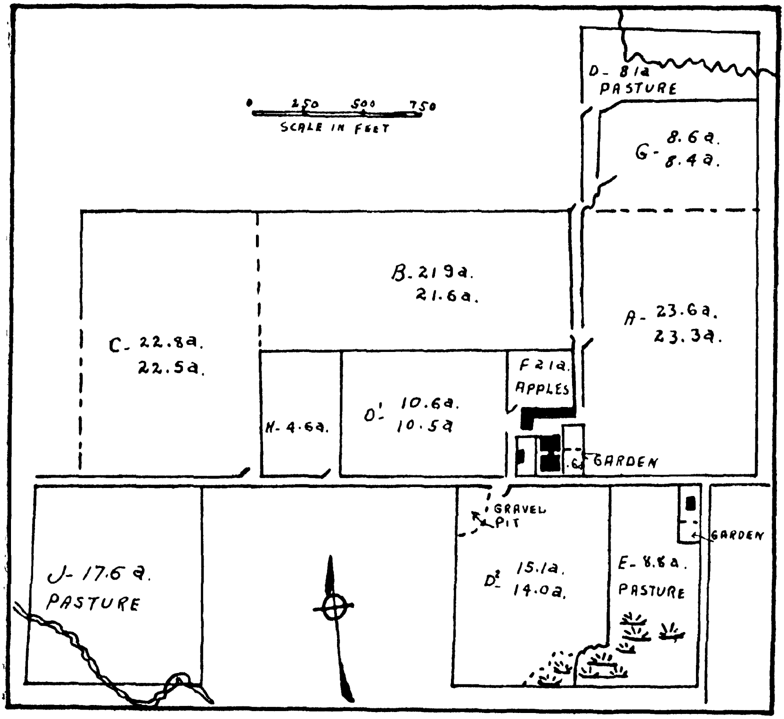
The layout of this farm was much better than that of most farms in the region. (See Figure 34.) The fields were quite regular in shape and fairly large, averaging 10.5 acres per field. The field arrangement was good, having an average distance from the farmstead to the fields of 32



From W. I. Myers, Cornell University Agr. Exp. Sta. Memoir 34.

Fig. 35. A Revised Layout of the Farm Shown in Figure 34.

rods. This farm when studied by Myers was a composite of an original farm and parts of two other farms. Fields *H* and *I* were added by the present owner. (See Figure 35.) Later 24 acres on the west side of the farm (Field *L*, Figure 35) were purchased. This latter acreage was purchased from a farmer who lived three fourths of a mile away. It had been seriously neglected by the former owner, was in a rather run-down condition, and was covered with stone and brush. In spite of many handicaps, however, a good farm layout was developed. (See Figure 35.)

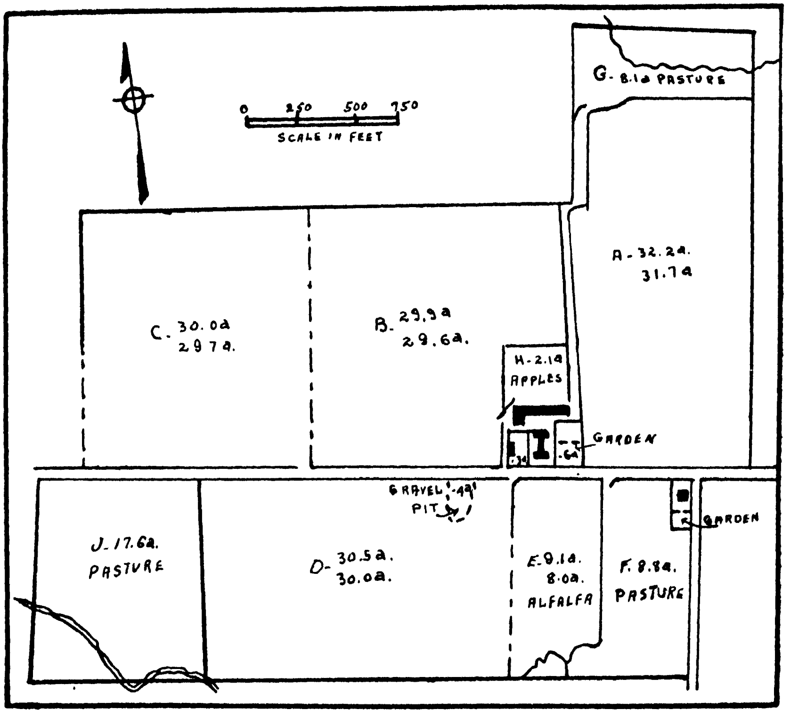


From W. I. Myers, Cornell University Agr. Exp. Sta. Memoir 34.

Fig. 36. A Suggested Rearrangement of the Fields of the Farm Shown in Figure 34.

A somewhat better plan was suggested according to which Fields *A* and *B* were to be consolidated into a new Field *A*. (See Figure 36.) This consolidation could be made easily, as it involves simply the removal of a wire fence between these two fields. Field *G* (formerly Field *C*) was to be devoted to alfalfa. It was also planned that Fields *E* and *F* would be consolidated into Field *B*.

To complete this layout some cleaning up would be required. To quote Myers: "An unnecessary rail fence between the new fields *B* and *C* has already been removed. The lower part of the west boundary of the new field *C* was formed by a brush and stone fence row which wasted a strip of land more than a rod wide. The brush ranged in size from small brush to trees 8 inches in diameter, and there were about 20 loads of stone. To clear up and plow this 36 rods of hedgerow required about 90 hours of man labor



From W. I. Myers, Cornell University Agr. Exp. Sta. Memoir 34.

Fig. 37. A Modified Arrangement of the Field System as Shown in Figure 36.

and 45 hours of horse labor. At 25 cents an hour for man labor and 40 cents for a team, the cost of this work would be \$31.50, or 87½ cents a rod. A quarter of an acre of land was reclaimed, worth from \$20 to \$25, and thus the net cost of removing the obstruction was low."

The suggested plan is a distinct improvement over the original. There are five large fields averaging 17 acres each and one small field of 8 acres in alfalfa, and, although the farm is much larger than formerly because of the addition of new land purchased, the average distance from the fields to the farmstead has been increased only from 32 rods to 38 rods. Furthermore, all the fields, with the exception of *H*, will be free from obstruction, and more land will be available for cultivation.

When this study was made and the above plan suggested, the owner was planning to improve still further his farm layout. It will be noted that there is a gap in the layout between Fields *J* and *I*. (See Figure 35.) The owner was of the opinion that the land between *J* and *I* could be purchased. If so, a new plan shown in Figure 37 would be possible. Such a plan provides for four 30-acre fields and an 8-acre field devoted to alfalfa. (See Field *E*, Figure 37.) These four large fields, in addition to being larger, are well shaped. The cost of this new layout, aside from the cost of purchasing Field *D*, will not be great. The more economical use of labor resulting from the new layout will, according to Myers, pay the entire cost in a few years.

Questions

1. What are the primary objectives in planning a farm layout? Do these objectives ever conflict? Illustrate.

2. What factors influence the layout? What is the relative importance of these factors?

3. How may the farm layout affect the use of (a) land, (b) labor, (c) capital goods, that is, machinery and fences?

4. How would you proceed in establishing a good layout?

References

App, Frank, and Waller , Allen G., *Farm Economics.* Philadelphia: Lippincott, 1938, Chapter IX.

Boss, Andrew, *Farm Management.* New York: Lyons and Carnahan, 1923, Chapter VI.

Hopkins, John A., *Elements of Farm Management.* New York: Prentice-Hall, 1936, Chapter XV.

Spillman, W. J., *Farm Management.* New York: Orange Judd, 1923, Chapter XV.

Warren, G. F., *Farm Management.* New York: Macmillan, 1916, Chapter 13.

New York State College of Agriculture (Cornell) Experiment Station, *Memoir 34,* "An Economic Study of Farm Layout," by W. L. Myers.

Ohio State University, *Agricultural Extension Service Bulletin,* Vol. XV, No. 1, "The Arrangements of Farm Fields," by J. I. Falchoner.

CHAPTER XV

Size of the Farm

HOW large a farm should a farmer operate? This is not simply a rhetorical question. The decision of the farm operator as to the size of farm he will attempt to operate may mean the difference between decided success or dismal failure. Indeed, a mistake made as to the size of farm is much more important than a mistake made as to the correct combination of the factors to be used in the production of crop or livestock product. In the case of the size of farm the investment is much larger than in the case of the production of a given crop or livestock product; hence, the loss or gain is much more significant. But the two questions are not dissimilar. One involves the question of how much labor, land, and capital shall be used in producing each of a given number of crops or livestock products for the purpose of obtaining the maximum net income of the farm business as a whole. The other involves the question of size of farm—that is, the total resources, land, labor, equipment, machinery, and material requirements which shall be associated with a given operator in order to obtain the same objective.

It can be said that the problem of determining the size of the farm involves the law of diminishing returns in much the same way as that of determining the optimum net income from crop or livestock production. When the size of the farm is the problem to be solved, the fixed factor is the entrepreneurial ability of the farmer, and the variable factors are land, labor, and capital goods. The purpose of this chapter is to explore the nature of this problem and to point out its significance in the field of farm organization and operation.

1. Measuring the Size of the Farm

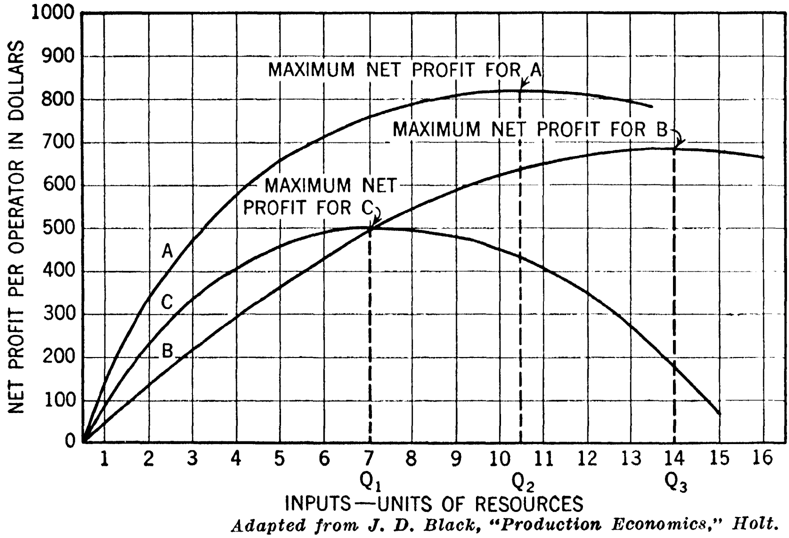
In the literature of farm management there is no generally accepted measure of the size of farm. In most discussions, the size of farm is measured by the number of acres. In some instances, the number of crop acres has been used. Occasionally, some other measure, as the amount of labor or the value of the total investment, has been used. A measure of size, however, cannot be expressed in terms of any one factor, since obviously the size of the business is determined not solely by any one factor but by the amounts of all of the factors associated with a single operator. For example, a grain farm located in the semiarid region of the United States will require much more land area than a truck farm located on Long Island, New York. In the first instance, farming is said to be extensive, in the latter intensive. Yet, in spite of the fact that fewer acres are used, the Long Island farm may be as large as the grain farm or larger. If, then, one factor cannot be used as a measure of the size, what should the measure of the size of business be?

A partial answer to this question can be obtained by referring again to the theory of diminishing returns. If the size of a business is to be measured by all the factors of production associated with a single operator, the size obviously must be measured by the quantity of the factors associated with such an operator. That is, the size should not be measured simply by acres of land or crop acres, or labor used, or capital invested, but by the total number of units of resources used in production. As the various factors of production cannot be added in a physical sense, they must be conceived of as that combination of land, labor, and capital used at the margin of production.[1] Assuming such a composite unit of resources, the question resolves itself into how many units should a given farmer associate himself with in order to obtain maximum net profits from the farm business? If this can be determined, the size of the farm will be known.

---

[1] Taylor, *Outlines of Agricultural Economics,* p. 163. See also Black, *Production Economics,* Chapter XIII.

According to the theory of diminishing returns, the net profit from each successive unit of resource will decline as additional units are associated with the operator. It is also true that as long as there is any net profit derived from an added unit, the total profit of the farm will be augmented. It may be said, therefore, that the operator will continue to increase the number of units until the net profit from the marginal unit is zero. It is at this point that the maximum net profit from the farm as a whole will be obtained, and



Adapted from J. D. Black, "Production Economics," Holt.

Fig. 38. The size of the farm is largely determined by the capacity and efficiency of the operator.

the number of units combined with the operator at this point constitutes a measure of size of the farm business.

This discussion may be elucidated by recourse to a diagram. Figure 38 is so constructed that curves *A*, *B*, and *C* show the entrepreneurial gains or profits for three different farm operators. It should be emphasized again that the fixed factor is the entrepreneurial ability of the farm operator. In the case of Operator *A*, the maximum profit for the whole enterprise is reached when approximately *Q*2 units of resources are used. If *A* should use more than this number, his profit would decline. For Operator *B* the point of maximum profits is reached beyond or to the right of that of *A* and *C*, or at *Q*3 units. Of the three operators, *C* used the least number of units of resources in order to reach the point of the maximum profits.

Figure 38 indicates also that the size of the farm will vary with the capacity and efficiency of each operator. Or, to state it more specifically, there is no such thing as a "best" or optimum size of farm that is applicable to all operators, even when they are using similar resources and are engaged in the same type of farming. Of the three operators represented, *B* has the greatest capacity, and *C* the least; that is, *B* can profitably associate himself with more resources than either *A* or *C*. But *A* and *C* have greater efficiencies than *B;* that is, they are able to obtain more profit per unit of resources used than *B*.

2. The Relation Between Area and Net Returns

The measure of size suggested in Section 1, although useful in a theoretical analysis, is not adapted to ordinary statistical procedure. Largely as a result of this, the students of farm management have resorted to other things, particularly area, as a measure of size. Area, assumed to be a satisfactory measure of size, has been correlated with net returns. The results of such correlation show almost invariably that as the area in the farm increases, the net returns increase also. This is apparently true of the data presented in Table 70. In this case, farms of 50 acres or less obtained on the average a labor income of $547; whereas farms of 171 acres or more obtained an average labor income of $1,485.

Aside from the fact that Table 70 is not properly constructed,[2] the relationship between area and labor income is

---

[2] Note the closed class interval of 50 in the first group and the open class interval in the last group, as compared with the closed class interval of 30 for all other groups. Note also that the number of classes is somewhat inadequate

TABLE 70

AVERAGE LABOR INCOMES ON FARMS OF DIFFERENT SIZES (320 FARMS), CHESTER COUNTY, PENNSYLVANIA [a]

Size of Farms	*Number of Farmers*	*Average Labor Income*
50 acres and less	27	$ 547
51 to 80 acres	94	666
81 to 110 acres	96	859
111 to 140 acres	65	950
141 to 170 acres	24	1,394
171 acres and over	14	1,488
All	320	862

---

[a] U. S. Department of Agriculture, *Circular 307*, p. 3.

more apparent than real, largely because area is a defective measure of size. That this is probably the case is indicated when the same data are arranged in a double frequency table, as has been done in Table 71. Examination of the data now shows that there really is no such marked functional relationship between the area of the farm and the labor income, as appeared to be true from Table 70. The explanation of this is simple enough. The labor in-

TABLE 71

RELATION BETWEEN SIZE OF FARM AND LABOR INCOME, CHESTER COUNTY PENNSYLVANIA [a]

Size of Farms	*Number of farmers*	*Number with Specified Labor Incomes*						
		Operated at a Loss	*$0 to $500*	*$501 to $1,000*	*$1,001 to $1,500*	*$1,501 to $2,000*	*$2,001 and over*	*Average*
50 acres and less	27	1	12	12	2	....	....	$547
51 to 80 acres	94	7	29	39	13	3	3	666
81 to 110 acres	96	8	22	33	15	11	7	859
111 to 140 acres	65	4	17	17	12	10	5	950
141 to 170 acres	24	3	2	3	5	3	8	1,394
171 acres and over	14	....	3	2	3	1	5	1,488
All	320	23	85	106	50	28	28	862

[a] U. S. Department of Agriculture, *Circular 307*, p. 3.

come, or any other measure of income, is not solely a function of area. There are other factors affecting income, and it is the influence of these other factors which has not been properly taken into consideration in the construction of Table 70.

If only the effect of area on the farm is to be determined, the effect of the other variables must be eliminated or held constant. According to Ezekiel, the number of acres in crops (the effect of other factors held constant) had a marked effect on returns in the case of 357 farms located in Chester County, Pennsylvania. In this study, Ezekiel found that a change of 10 acres in crops changed the operator's earnings $153 (Table 72). Indeed, the area in crops is the most important factor affecting returns, but it is by no means the only one. For example, the input of one month's labor affected the returns by $44.

TABLE 72

NET REGRESSION OF OPERATORS' EARNINGS ON SEVERAL FACTORS[a]

On the Average, for Each Increase of—	*Operator's Earnings Increased (Dollars)*	*On the Average, for Each Increase of—*	*Operator's Earnings Increased (Dollars)*
1 cow	–22	$100 in crop receipts	+69
10 acres in crops	–153	$100 in dairy receipts	+63
10 acres in pasture	–24	$100 in beef receipts	+1
10 points on crop index	+2	$100 in hog receipts	+64
1 month in "labor index"	–44	$100 in sheep receipts	+22
10 per cent in dairy feed purchases	–8	$100 in poultry receipts	+67

---

[a] U. S. Department of Agriculture, *Bulletin 1400*, p. 55.

Area as such in some types of farming appears to have little or no effect on returns. For example, Vernon and Ezekiel found that in Appomattox and Pittsylvania Counties, Virginia, the area as measured by plowed acres accounted for only 0.4 per cent of the operators' earnings in the former and 2 per cent in the latter county. In both counties the area in tobacco has more effect than any other input factor. (See Table 73.)

TABLE 73

RELATIVE IMPORTANCE OF CAUSES OF VARIATION IN OPERATORS' EARNINGS[a]

Variable	*Appomattox Records (Per Cent)*	*Pittsylvania Records (Per Cent)*
A—Tobacco sold per acre	34.5	39.5
B—Acres in tobacco	16.3	16.6
C—Income per plow acre not in tobacco	6.7	0.1
D—Plow acres (equivalent to plow acres not in tobacco)	0.4	—2.0
Total determination	57.9	54.2

---

[a] Virginia Agricultural Experiment Station, *Bulletin 241*, p. 48.

3. Economy in the Use of the Factors of Production

The object of the foregoing discussion is to indicate the complex nature of this subject. Evidently, returns may or may not be increased by increasing the area of the farm. Increasing the number of acres may bring higher returns if the land area is out of adjustment with respect to other factors of production such as labor, equipment, and management. That this is often the case is indeed true, and for this reason it is important to consider somewhat more specifically how changes in the area of the farm may affect returns. In this discussion size of farm will be used in the usual sense indicating the area operated.

a. *Capital.* It is often possible to use farm machinery more effectively by increasing the size of the farm. A small farm may require almost the same outlay for machinery as a farm twice as large. That is, in the case of certain kinds of farm machinery such as harrows, plows, mowers, and grain drills, a doubling of the acreage in the farm does not, as a rule, necessitate doubling the number of these implements. However, as the acreage is increased, an additional outlay of machinery may be necessary. An increase in the size beyond this point does not mean that the number of units of the different kinds of machines or implements has to be increased. The problem may be solved by adding units of a higher capacity, that is, by adding a somewhat larger harrow, a gang plow in place of two walking plows, a mower with a wider cut, and so on. That the problem is met in this way is substantiated by the data presented in Table 74, which show that as the size of the farm increases, improved machinery and implements are employed to a larger extent.[3]

TABLE 74

PERCENTAGES OF FARMERS REPORTING VARIOUS MACHINES IN USE ON 237 FARMS, TAMA COUNTY, IOWA [a]

Item	*Grouped by Acres Operated*								
	All Farms	*80*	*120*	*160*	*200*	*240*	*280*	*320*	*Over 340*
Wagons	100%	100%	100%	100%	100%	100%	100%	100%	100%
Buggies	82	85	91	76	92	80	75	76	92
Sleds	97	100	94	96	94	100	100	100	100
Walking plow	58	54	47	61	63	51	69	53	75
Sulky and gang plow	98	92	97	99	97	100	100	100	100
Harrows	98	92	97	100	100	95	100	94	100
Disks	99	100	97	100	97	100	100	100	100
Cultivators	100	100	100	100	100	100	100	100	100
Corn planters	97	97	97	97	97	100	100	100	92
Drills and seeders	86	75	75	77	77	88	100	94	92
Corn binder	37	..	28	25	46	45	38	65	75
Grain binder	90	85	69	92	94	92	100	100	100
Mowers	92	62	91	97	89	88	100	100	100
Rakes	55	46	31	55	60	58	81	53	92
Loaders	78	62	75	75	83	76	88	94	92
Manure spreader	93	85	84	93	94	98	94	94	100
Elevators	62	62	41	54	69	71	81	71	75
Silage cutters	16	8	6	7	17	20	12	41	50
Grain cleaners	27	8	16	31	23	24	25	47	58
Feed grinder	58	54	62	54	51	51	62	76	75
Engine	78	62	81	75	74	83	81	76	100
Tractor	25	15	19	16	11	44	25	47	50
Threshing machine [b]	32	23	34	31	23	29	98	94	100
Autos and trucks	92	85	97	90	86	98	19	59	58

[a] *Research Bulletin No. 88*, Iowa State College.

[b] Part interest in threshing machines ranged from one-half to one-twelfth interest.

Economy in the use of fencing material is possible as the size of the farm increases. As large fields are likely to be found on large farms, the cost of fencing per acre of land tends to fall. This fact is shown in Table 75.

---

[3] *Iowa Bulletin No. 88*, pp. 285–286; U.S. Department of Agriculture, *Bulletin No. 341.*

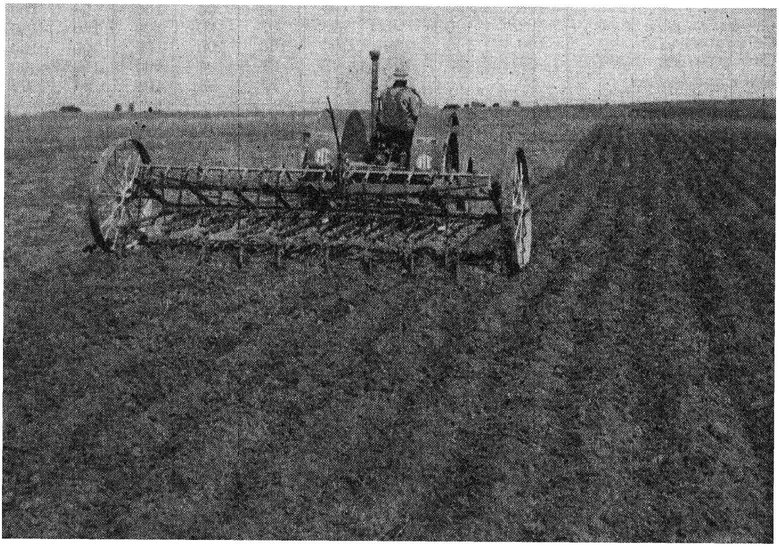
TABLE 75

RELATION OF SIZE OF FIELDS TO ECONOMY OF FENCING AND OF LAND IN CROP FIELDS COMPLETELY FENCED[a]

Size of Field (Acres)	*Number of Fields*	*Average Size of Fields (Acres)*	*Rods of Fence to the Acre*	*Per Cent of Crop Land Occupied by Fences*
Less than 4	26	2.15	36.7	4.64
4–7.9	41	6.30	21.1	3.75
8–11.9	64	9.84	16.7	2.66
12–15.9	27	13.28	15.1	2.26
16–23.9	24	18.44	12.7	1.85
24 or more	12	38.33	9.0	1.12
Total	194	.....	....	....
Average	...	11.37	15.1	2.29

---

[a] Cornell University Agricultural Experiment Station, *Memoir 34*, p. 415.



Courtesy of the International Harvester Co.

Fig. 39. Machines of a higher capacity can be economically employed as the size of the farm increases.

The importance of circulating capital varies greatly with the type of farming. Feed, for example, is relatively more important in dairy farming than in wheat farming. The consumption of fuel and oil is more important on farms that use tractors than on those which use horses or mules exclusively. The importance of seed also varies with the type of farming. Seed is of greater importance in the growing of potatoes than in the production of grain. Hence, the possibilities of utilizing circulating capital vary greatly with type of production. For example, as the size of the dairy herd is increased, a much better use of feed may be realized. A certain part of the feed will be lost in any case; but, as the amount of feed handled increases, it is possible to reduce the percentage lost. On larger farms it may pay to use improved types of machinery for drilling the seed, and this may be a means of economizing seed. Drilling the seed usually results in better germination, and the grain will be less likely to be damaged by winter conditions when grain is sown in the fall. On small farms it may not pay to buy or to use a grain drill. Hence, a large farm may, because of the fact that there is enough work to make it worth while to use a drill, secure these advantages. When tractors are used, the large farm has a decided advantage over the small farm because the tractor cost per acre declines rapidly as the size of the farm increases.[4] (See Table 76.)

b. *Buildings.* The investment in farm buildings may not increase as rapidly as the size of the farm increases. For example, doubling the size of the farm does not mean that the annual building cost will be doubled. The explanation of this is rather simple. The cost of constructing a building, material and design remaining the same, does not increase at the same rate as its capacity. This means that if the capacity of one building is twice as great as that of another building of the same design and grade of material, the cost will not be twice as great. Furthermore, a large barn may have a decided advantage over a smaller barn

---

[4] Tolley and Humphries, "Tractors and Horses in the Winter Wheat Belt, Oklahoma, Kansas, Nebraska," U. S. Department of Agriculture, *Bulletin No. 1202,* Table 40, p. 35.

TABLE 76

COST OF POWER FOR DRAWBAR WORK ON FARMS OF DIFFERENT SIZES [a]

Size of Farm (Crop Acres)	*Number of Farms*	*Average Size (Crop Acres)*	*Cost of Keeping Work-stock*	*Cost of Tractor for Drawbar Work*	*Total Cost per Year*	*Cost per Crop Acre*	*Per Cent Tractor Cost Is of Total*
Western area:							
160 to 239	5	219	410	256	666	3 04	38
240 to 319	17	281	406	366	772	2 75	47
320 to 399	18	350	395	433	828	2 37	52
400 to 479	19	441	362	521	883	2 00	59
480 to 639	22	555	670	658	1,328	2 39	50
640 to 799	14	703	578	667	1,245	1 77	54
800 and over	12	1,054	843	547	1,390	1 32	39
Total and average	107	516	522	520	1,042	2 02	50

---

[a] U. S. Department of Agriculture, *Bulletin No. 1202*, p. 39.

with respect to the use of labor-saving equipment of various sorts. It is often possible to install labor-saving equipment in large barns at less cost per unit of barn capacity than in small barns. Finally, there are some farm buildings, such as the farm dwelling, the size of which does not depend upon the magnitude of the farm business. The dwelling is not increased, as a rule, as rapidly as the size of the farm business is increased.

c. *Labor.* It has been pointed out that large farms may use improved machinery more advantageously than small farms. In most instances, the improved machinery requires less labor, at least relative to the work done, than simpler types of machinery. From this it follows that labor may be used more effectively on the larger farms when improved machinery is employed. But even aside from the possible use of improved machinery on large farms, there are many farm operations which require more than one man. If services of this extra man cannot be acquired when needed and dispensed with when the need is over, it may mean that an extra man must be hired for the year or at least for a crop season. On the small farms it may not be possible to use the services of the extra hired man as effectively as they would be used on large farms. Miscellaneous jobs and chores may be executed more effectively as the size of the farm increases, since these do not require labor in proportion to their magnitude. As Warren points out, it does not take twice as much time to care for six horses and twelve cows as for three horses and six cows.[5] Thus, on large farms relatively less of the total available labor will be used

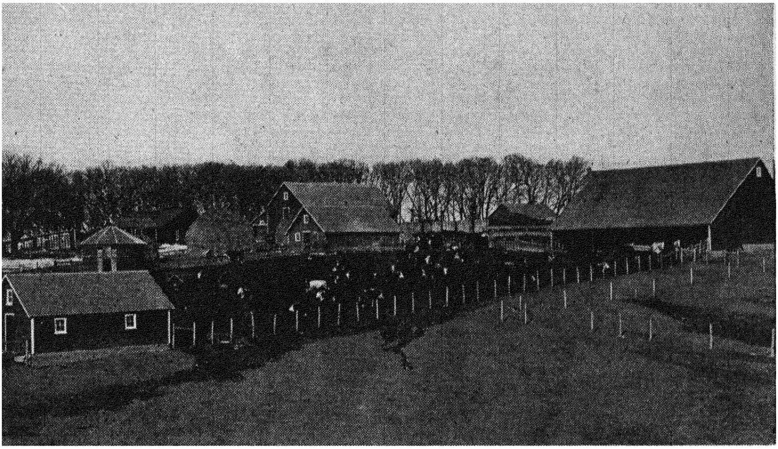


Illustration from Bu. of Agr. Econ.

Fig. 40. As the size of the farm increases, buildings tend to be used more economically.

TABLE 77

SIZE OF FARM RELATED TO EFFICIENCY OF LABOR ON 586 FARMS OPERATED BY OWNERS [a]

Acres	*Area Farmed per $100 Worth of Labor*
30 or less	5 acres
31- 60	12 acres
61-100	18 acres
101-150	22 acres
151-200	26 acres
Over 200	30 acres

[a] Warren, *Farm Management.*

---

[5] Warren, *Farm Management.*

in doing these miscellaneous jobs and chores than on small farms. (See Table 77.)

d. *Horses.* Many authorities believe that horse power can be used more effectively on large farms than on small ones. (See Table 78.) There are several reasons why this may be true. On the small farms where the horse power is

Courtesy of Horse and Mule Ass'n of America.

Fig. 41. On large farms horse power can be used more effectively than on small farms because of greater flexibility.

TABLE 78

SIZE OF FARM RELATED TO HORSES ON 586 FARMS OPERATED BY OWNERS [a]

Acres	*Average Size (Acres)*	*Average Number of Horses*	*Acres per Horse*
30 or less	21	1.4	15
31- 60	49	2.3	21
61-100	83	2.8	30
101-150	124	3.4	37
151-200	177	4.3	41
Over 200	261	5.3	49
Average	103	3.1	33

---

[a] Warren, *Farm Management*, p. 256.

not fully utilized, an addition to the acreage to be cultivated, within certain limits at least, does not require additional horses, but it may mean simply that the available horse power is more completely utilized. Of course, if the size of the farm is increased beyond a certain point, an additional horse may be required. But within certain limits the number of horses need not be increased as the size of the farm is increased.

Small farms, as a rule, cannot utilize improved types of farm machinery because the successful operations of such machinery require more horses than it pays the small farm to keep. Hence, the number of acres that can be cultivated per horse is greatly increased by the aid of power machinery.

It often happens that horse power can be more fully utilized when the number of horses is large enough to permit the use, as the occasion may demand, of teams of different sizes. Thus, on a farm large enough to have 5 horses, several team combinations may be employed. With 5 horses, for example, the farmer could have one 4-horse team, if the work to be done required a 4-horse team, with the fifth horse to do work requiring only a single horse. Or, he could have one 3-horse team and one 2-horse team. Or, he could have two 2-horse teams, with the fifth horse available for other farm work. The larger the number of horses, the more flexible the horse power becomes. Hence, the farmer operating a large farm may, if he is a good manager, use the available horses to a better advantage than a farmer operating a small farm.

The greater flexibility of horse power on the larger farms makes it possible for farmers operating such farms to effect a better combination of farm enterprises. Since the horse power is more flexible, the farmer is able to do the important farm work quickly and at the right time. In the Corn Belt, for example, more successful farmers have a larger percentage of the total crop area in corn. They are able to handle this larger acreage chiefly because the horse power is flexible. Also, of course, because, by having more horse power, they can employ more and better farm machinery. As corn is the most profitable crop, the output on these large farms is likely to be relatively larger than the output on small farms. Hence, there is a tendency for the horse labor cost to increase at a somewhat less rapid rate than the output.

Large farms, at least in some areas, employ tractors more extensively than small farms. On the larger farms tractors may displace horse power. That is to say, the output is in no way reduced, and possibly it is increased by the use of tractors; but the horse power employed becomes less as the size of the farm is increased. A large farm permits the size of the field to be large enough for the efficient operation of large teams and improved machinery. On small farms the fields are as a general rule too small to make the best use of large teams and efficient farm machinery.

e. *Land.* The size of the farm may be a factor affecting the utilization of land. In an exhaustive study of farm layout in New York, Myers found that the total area available for crop production was affected by such obstacles as fences, driveways, and stone piles. The percentage of the total area that was not used because of such obstructions decreased as the size of the farm increased; whereas the loss in land use was 5.48 per cent for farms of less than 100 acres, the loss was only 3.25 per cent on farms of 175 acres or more.

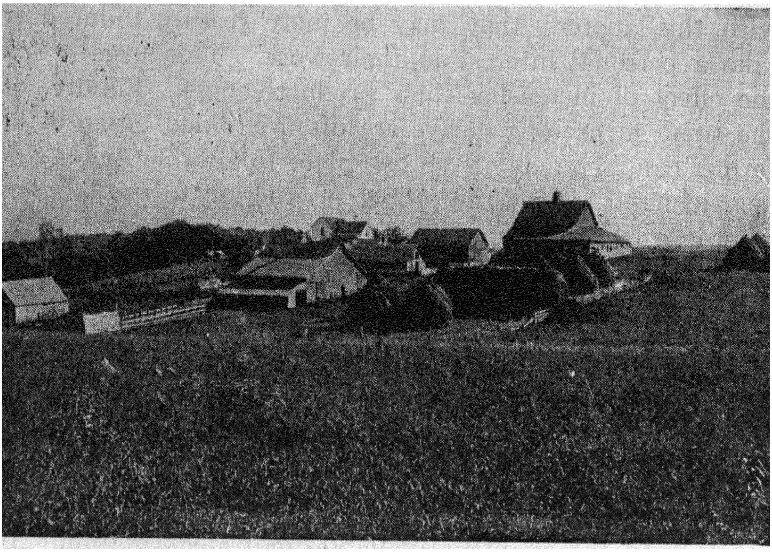
f. *Management.* On most farms the farmer is both a laborer and a manager. When the size of the farm is small, the general tendency is for the labor function to be as important as the management function. As the size of the farm increases, the tendency is for the management to become more important than labor. When this happens, the farmer, being relieved from physical effort, may become a more efficient manager. On a large farm there is always the possibility of reducing many of the tasks to a routine. The manager may then give his attention more largely to planning and to solving the more difficult problems connected with the business. But the small farm is not without its advantages even in management. The fact that the operations may be reduced to routine when the farm is large may prevent changes in the farm production in response to changes in price or cost conditions. Furthermore, since on the small farm the farmer is more intimately associated with the laborers, they may be more readily induced to take a personal interest in their work. This usually has the effect of increasing their productiveness. Finally, on the small farm, long delays are often avoided because the farmer can go quickly from one place to another or may be near at hand to give the proper instruction to the laborers when the occasion arises.

4. Economy in the Use of Products

a. *By-products.* On practically every farm there are certain products or materials which are incidentally produced along with the main or principal products. Straw, corn stover, skim milk, and aftermath are examples of these products, and all are nonmarketable, as a rule, unless transformed. The economic utilization of these by-products depends upon the quantity available for transformation. In this respect, a large farm may have a decided advantage over a small farm. Normally, these materials or by-products will be utilized if the resulting products sell for enough to cover the variable expenses involved in their conversion. Labor, buildings, and, to some extent, machinery, which make up the bulk of the fixed charges, can be more effectively utilized if these by-products are converted. In short, the output of the farm can be increased without adding to the fixed expenses.

The advantage of the large farm over the small farm in the utilization of by-products cannot be pushed too far. The units normally used in converting these products are small and inexpensive. Hence, the small farm may, as a rule, keep a few hogs, cattle, sheep, or hens without great risk and at small outlay. The advantage under actual conditions which the large farm has over the small farm is, therefore, likely to be slight.

b. *Intermediate products.* The farmer, especially if he is engaged in general farming, often has to decide what he will do with certain marketable products, such as corn, oats, wheat, and barley. Shall these be marketed direct or changed into other products? The decision, of course, will depend, to a large extent, on the relative price of the products. It may also depend upon the quantity of the marketable products which are available for feeding purposes. If the quantity is small, it may not pay to bother feeding it. Large farms, therefore, owing simply to larger quantities of these directly marketable products, may have advantage over small farms. In the case of a small farm, it may pay the farmer to sell his products untransformed, especially if some profitable alternative for his labor is available, such



Courtesy of Bu. of Agr. Econ.

Fig. 42. On large farms grain and roughage can be used, as a rule, more economically than on small farms.

as outside employment. Of course, this alternative may be available to the farmer on the larger farm, but, as a rule, the miscellaneous types of labor on the larger farm necessitate the farmer's attention to such an extent that he cannot avail himself of outside work. Hence, if he has to stay on the farm anyway, even a small gain made by feeding the directly marketable products will probably be worth the trouble involved.

In the case of intermediate products as in the utilizing of nonmarketable materials, the advantages of the large farm may in actual practice be of no marked significance. The unit employed in the consumption of the directly marketable products is so small and the time required relatively so insignificant that the small farm may convert these products as economically as the large farm and often without sacrificing any alternative for outside work that may present itself. Members of the farm family may take care of the livestock if the farmer's time is being utilized off the farm.

5. Reduction of Risk

In manufacturing, risk tends to be associated with the scale of production. As the scale of operations is extended, the entrepreneur or business manager must extend the scope of his supervision. The number of decisions which must be made is, as a consequence, increased. This reduces the chance of any one decision being serious or extremely unfortunate to the orderly conduct of the business. In short, there is a greater probability that bad decisions will be offset by good ones, and this gives a high degree of constancy and dependability to the total result.[6] Probably no such relationship between risk and larger-scale production in agriculture really exists. As a general thing farming is not projected on a large enough scale to balance in this way the good against the bad decisions. The fact is that, because of the area over which large-scale production in farming has to be extended, the difficulty encountered in the transmission of orders is increased. In this respect the small farm has a decided advantage over the large farm.

---

[6] Knight, *Risks, Uncertainty, and Profit*, p. 252.

Losses from weather conditions, insect pests, and plant and animal diseases are important factors in farming. Because of the difference in the numbers, the loss of a cow, a hog, or an acre of crops is not so important on a large farm as on a small farm. To the extent that this is true, a large farm has the advantage over a small farm. However, in case of total destruction, the loss will be larger on the large farm, and the destructiveness of many diseases, pests, and storms is such that the damage is likely to be in proportion to the size of the herd or of the crop subject to damage.

Risk may often be reduced by diversification. However, there does not appear to be any definite relationship between diversification and the size of the farm. A small farm of the same general type of farming may be and usually is just as diversified in its production as a large farm. Hence, there does not appear to be an advantage in this respect of the large farm over the small farm.

6. Advantages in Buying and Selling

In some instances, depending on the type of commodities produced, a large farm may have an advantage over a small farm in buying and selling. As a general rule, better terms can be obtained when goods or materials are purchased in large lots. In fact, if the farmer purchases in large enough quantities, he may buy at wholesale rather than at retail prices and, therefore, may have a decided advantage in this respect over a farmer who has a small business.

Not less important are the advantages in selling, especially if the farmer is producing specialties of high quality. If a large quantity of these are produced, the farmer can advertise with less cost per unit of product. The farmer also can better afford to spend some time in seeking special or more advantageous markets. Also, better service by middlemen may be obtained and at less cost per unit as the quantity and quality are increased. These advantages, however, are not so important in the case of staple products as in the case of specialties. For the staple products there is usually a regular market price which is open to all farmers irrespective of the quantity sold. The only saving in this latter case is to be gained by reducing marketing costs as a result of shipping in large quantities.

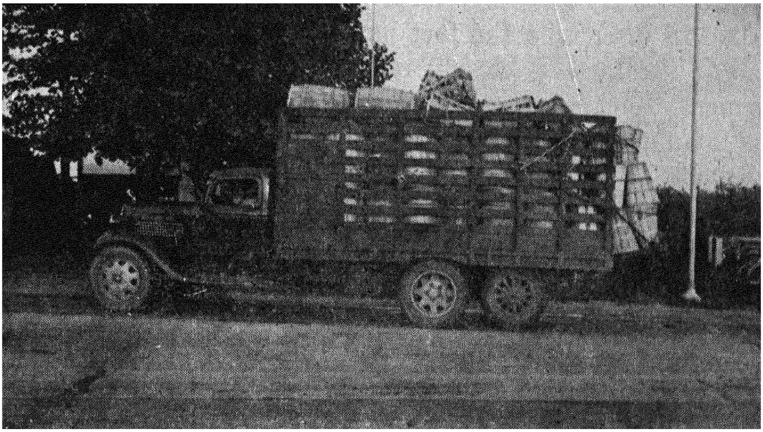


Illustration from Farm Credit Administration.

Fig. 43. Hauling costs may be reduced when the volume of production is large enough to warrant the purchase of a truck.

7. Economies in Financing

The advantages that the large farm has over the small farm in the matter of financing are not likely to be important. In industry the large firm may, and usually does, enjoy a marked advantage in this respect over the small firm. Lower interest rates, due to safety of investment, and more advantageous sale of securities, such as bonds or stocks, are two of the important advantages enjoyed by large industrial firms. The farmer, however, has no occasion to sell securities. Farming is not financed in that way. The large farmer, however, has a better credit rating as a rule with the banker than the small farmer. His loans are likely to be larger than those of the small farmer;

and, hence, the cost of the loans in commissions may be reduced materially. Large farmers are more likely to be more businesslike than small farmers and to use banking facilities to a greater extent. Instead of buying on time, the large farmers secure loans from their bank and buy with cash. In this way, as many studies have shown, they save considerable money.

8. Conclusions on the Size of the Farm

In this discussion the fact has been emphasized that the size of the farm is closely related to the capacity of the farmer. It cannot be said that an increase in the size of the farm will increase the net farm income. This idea may appear to be contrary to fact, since net income and size are usually correlated, *i.e.*, as the size of the farm increases, the net income also increases. From this relationship the incorrect deduction has been made that to increase the income of a given farm, the farmer should increase the size of his farm. But such a deduction cannot be made. On the contrary, such advice might very well result in a decrease in the net farm income.

Why are there these two concepts, namely, that net farm income increases as the size of the farm increases, and that increasing the size of a given farm may result in a decrease in net income? The question is an important one that is not, as a rule, clearly understood. In any given case it may be assumed that the farmer has tried, to the best of his ability and knowledge, to associate himself with that size of business which will yield the maximum net returns. Assuming this to be correct, the farmer has, in any given case, assembled that amount of land, labor, and equipment which for his capacity and conditions will yield the maximum net income. If, then, this balance between capacity and size is disturbed by either increasing or decreasing the size of the farm, net income will most surely decline. It should not be concluded, however, that a given farmer cannot increase his net income by adjusting the size of his farm.

It seldom, if ever, happens that farmers have succeeded in obtaining a perfect balance between their capacity and the size of the farm they are operating. When this is the case, changes in the size may result in an increase in the net income, and it has been the chief purpose of this chapter to point out how these adjustments can be effected.

Questions

1. Explain how, in research studies, the importance of size of farm has been often misinterpreted.

2. In what ways, if any, has the small farm an advantage over the large farm?

3. Which makes the more economic utilization of horse power, the large or the small farm?

4. Which makes for the more economy in management, the large or the small farm?

5. Taking all factors into consideration, and with conditions as they are today, what size farm would you deem the most economical for one man to manage? Explain your answer.

References

Adams, R. L., *Farm Management.* New York: McGraw-Hill, 1921, Chapter IV.

App, Frank, and Waller, Allen G., *Farm Economics.* Philadelphia: Lippincott, 1938, Chapter II.

Black, J. D., *Production Economics.* New York: Henry Holt, 1926, Chapter XXI.

Gray, L. C., *Introduction to Agricultural Economics.* New York: Macmillan, 1924, Chapter VIII.

Holmes, C. L., *Economics of Farm Organization and Management.* Boston: Heath, 1928, Chapter XI.

Knight, F. H., *Risks, Uncertainty, and Profit.* London: School of Economics, 1933.

Spillman, W. J., *Farm Management.* New York: Orange Judd, 1923, Chapter XVI.

Taylor, H. C., *Outlines of Agricultural Economics.* New York: Macmillan, 1931, Chapter XIII.

Warren, G. F., *Farm Management.* New York: Macmillan, 1916, Chapter 7.

U. S. Department of Agriculture, *Bulletin 1202,* "Tractors and Horses in the Winter Wheat Belt, Oklahoma, Kansas, Nebraska," by H. R. Tolley and W. R. Humphries, Table 40.

CHAPTER XVI

Selection and Acquisition of the Farm

THIS and the following chapter will be devoted to the consideration of the selection and acquisition of the instruments of production. The first of these to be considered is that of the farm. Of the instruments of production, the selection and acquisition of a farm probably presents the most difficulty. There are several reasons why this is so. In the first place, the selection of the farm is complicated by the dual character of the farm business. The prospective renter or purchaser must not only consider the farm in its purely business aspect but he must also consider it from the point of view of a residence or home. These two aspects are often antagonistic. One often hears the remark that a certain farm is excellent from the standpoint of farming but is not a good place to live. That is to say, the conditions which are conducive to a good home may not be conducive to good farming and vice versa.

The immobility of land constitutes a second reason why the selection of land is more difficult than the selection of any other instrument of production. Immobility is a distinct character of land. Other cost goods may be moved from place to place with little difficulty, but land cannot be moved. Mistakes made in the selection of farms, therefore, are likely to be more serious than those made in the case of any other element of production. Of course, one may sell land if a mistake has been made but usually only at a serious loss or at great inconvenience. Furthermore, on account of the immobility of land, it is often difficult to modify the size of the farm if a change in combination of land with other factors becomes, for any reason, desirable. Here again, land may be sold or purchased, but it is more difficult to add to the farm by purchase or to reduce its size by sale than is the case of any other resource.

Finally, land is usually the most costly of the factors of production. According to the Fifteenth Census, investment in land, exclusive of buildings, represented 61 per cent of the total investment in all farm property, and land with buildings, 83.7 per cent of the total. With the increase in population and with the further development of our large industrial centers, land values will undoubtedly continue to be, relatively at least, the most expensive factor.

For these reasons, the selection and purchase of a farm is a vital problem and should be undertaken only after a careful study has been made of the conditions which are likely to affect the success of the business and the satisfaction to be derived from farm life. It is not to be expected that any discussion of this subject can do more than indicate roughly some of the aspects that should be considered; nor can any discussion take the place of common sense, native ability, and experience and training in farming.

1. Some Economic Factors Affecting the Acquisition of a Farm

There are several things, of an economic character, which should be considered in buying or renting a farm. Among these probably the most important are the relation between contract and economic rent, the rate of interest, taxes, and funds available for the purchase of a farm.

a. *Relation between contract and economic rent.* When a person rents a farm he pays a stipulated rent either in cash or in a part of the products produced. This sum, in money or commodities, is known as *contract rent,* because it is a part of an agreement between the landlord and the tenant. The contract rent may or may not correspond to what is called the *economic rent* of the farm, or that part of the income from the farm as a whole which may be attributed to the property owned by the landlord. The relationship between contract and economic rent is important when a man is deciding whether to rent or buy a farm.

Under fairly stable price and cost conditions, the contract rent is likely to approximate the economic rent of land, *i.e.*, the landlord will get, as a rule, all of the income produced by the farm property which he owns. The situation is quite different under conditions of rapidly rising prices. When prices rise rapidly, production costs tend to remain constant, or to rise much less rapidly than prices. This means that the economic rent increases, but the landlord is unable to get immediately all of this additional rent, because of the fixed agreement with the tenant. In short, the tenant is able under these conditions to get a part of the economic rent from the farm. The landlord, however, will not hesitate to raise the rent as soon as possible, *i.e.*, as soon as his agreement with the tenant expires. But, even if the contract rent does rise, the tenant is in a position to decide whether or not to rent the farm, that is, to renew the leasing agreement.

The purchase of a farm, as contrasted to renting, is according to an agreement which is in effect until the outstanding indebtedness is paid. Any change in the relation between prices and costs which may occur thereafter directly affects the purchaser. Subsequent changes in the relation of costs and prices may allow liquidation of the encumbrance more quickly than was anticipated by causing high net returns; or they may lower net income to the extent of preventing payment and forcing foreclosure. At any rate, there is a large element of risk in purchase, especially at the time when the relation between costs and prices results in abnormally high net returns.

Before purchasing a farm it would be well, therefore, to determine whether or not the current level of land prices is justified. A price is attached to land because there is a demand for it. This demand results in part from the fact that income can be derived from its use and in part from other causes, such as speculative craze, inflation of the currency, and the social prestige which ownership of land often confers on owners. The price, however, is determined, to a large extent, by the net income. In 1920, for example, land prices were 70 per cent,[1] and net income 74 per cent above the prewar level.[2] The cost of goods used in production of agricultural products was 89 per cent above the prewar level, while prices received were 105 per cent above. There was, then, in this case a relationship between costs and prices which resulted in a higher net income than can be expected under normal conditions. From 1921 to 1930 these costs averaged 48 per cent above the prewar level, while prices averaged only 32 per cent above. This change in the relative importance of prices and costs tended to lower net income attributable to land to such an extent that demand for it declined and land prices fell markedly. Farmers buying land just prior to 1919, or just following, were buying at the wrong time.

The necessity for caution in the buying of land during periods of high prices is illustrated by the results occurring in many parts of the United States during and just following World War I. For example, Forster in a study of the land boom in the Bluegrass Region of Kentucky,[3] and Gray and Lloyd in a similar study in Iowa,[4] found that many persons who bought land during this period lost heavily. In Kentucky, for example, the average loss of 195 farmers who bought and sold farm land during the boom was $5,579.

b. *The current rate of interest.* Another significant factor affecting the price of land is the current rate of interest. A change in this rate may change the price of land. Suppose, for example, that the net rent of a given piece of land is $6 per acre and the current interest rate is 6 per cent; then the capital value of the land is $100, or $(\$6 \times 100)/6 = \$100$. To the extent that the interest rate is a factor in determining land prices, then a lowering of the interest rate, net rents remaining the same, will certainly cause an increase in land prices. Or, if the net rents were declining, but somewhat more slowly than the rate of interest, then also land prices might conceivably rise, indeed would rise, if not influenced by some other cause or causes. It is safe to say that land prices will decline if net rents decline and interest rates remain constant. And conversely, if rents rise, interest rates remaining the same, land prices will rise. Hence, the current outlook for interest rates is important in buying land.

---

[1] U. S. Department of Agriculture *Yearbook,* 1920, p. 825.

[2] National Bureau of Economic Research, *Income in the United States,* 1922.

[3] Forster, G. W., "Land Prices and Speculation in the Bluegrass Region of Kentucky," Doctor's Thesis, University of Wisconsin, 1920, pp. 37–38.

[4] Gray, L. C., and Lloyd, O. G., "Farm Land Values in Iowa," U.S.D.A. *Bulletin No. 874,* pp. 8 and 9.

c. *Taxes.* Taxes on real estate constitute an element of cost that the owner must assume. It has been estimated that taxes on farm real estate in 1930 represented about 1.5 per cent of the investment. In other words, assuming 6 per cent returns on the investment in real estate, one fourth of this had to be paid in taxes. Taxes tend to advance during periods when land prices are rising, but they do not fall so rapidly as land prices. Hence, the person who buys land at the peak of prices must anticipate a heavier tax burden. Such a situation may, and in many cases has, become extremely embarrassing to the purchaser.

d. *Funds available.* Another consideration in buying land is the most effective use of funds available. With a limited amount of funds, the question arises as to the advisability of putting these funds into purchase of a farm or of using a part of such funds in the purchase of feed, seed, fertilizer, and materials. It is generally considered poor management to deplete funds to such an extent as to use credit extensively for operating expenses, because such credit is usually more expensive (interest rates are higher) than mortgage credit. This depletion of funds is inadvisable, especially when the farmer has to pay interest rates varying from 10 to 20 per cent or more for short-term credit in order to save from 5 to 8 per cent on the indebtedness. Suppose, for example, a farmer has $2,000 in cash that can be used to pay on a farm costing $5,000. If he uses the full $2,000, the balance due on the farm is $3,000. The question is whether or not it would be better to pay only $1,000, if the rate of short-term credit is 20 per cent and the rate on the mortgage is 5 per cent. According to these conditions, it would cost a farmer, if he paid only $1,000 down—leaving a balance of $4,000—$50 a year more for mortgage credit than if he paid $2,000 in cash. But, if he paid $2,000, it would cost him $200 to finance his farm operations; thus he would lose $150 by paying $2,000 instead of $1,000.

2. Some Important Physical Factors Affecting the Choice of a Farm

In buying a farm, attention should be given also to such things as the distribution of the land area, topography, soil condition, farm layout, condition of the buildings, water supply and drainage, and location of the farm with respect to roads, schools, and markets.

a. *The distribution of the land area.* By distribution of the land area is meant the division of the total area into crop land, pasture, woodland, wasteland, and the like. This subject is important because in most cases it is the crop land, or potential crop land, that determines the desirability of a farm. A given farm may at first appear to be cheap but may prove to be really dear because the crop land is a small proportion of the total land area. It is always desirable, therefore, to determine quite accurately the land actually in crops and the land which may be made easily available for crop production. The distribution of the land area may best be determined by making a map of the farm showing the area in crops, potential crop land, pasture land, woodland, and roads.

b. *Topography.* In some types of farming, topography may not be of great importance because the farming followed does not require modern machinery; but, where improved machinery is required, the topography becomes an important factor in the selection of a farm. When machinery must be used, level or gently rolling land free from natural or artificial barriers is necessary. In some sections of the country, especially in the South, the way in which terraces are constructed affects the use of machinery. High, sharp terraces may constitute serious obstacles to the use of machinery. On the other hand, the low, rather broad-base terraces are much more convenient to the use of machinery. Other things being equal, the farm possessing broad, well-constructed terraces is to be preferred to a farm which has sharp, narrow terraces.

Topography is also important in connection with the subject of erosion. Land which is steep is more subject to erosion than land which is fairly level or gently sloping. If topography is of such a nature that erosion will take place readily, it may seriously affect the general plan of operation. In some areas fall plowing is desirable because it gets much work out of the way that would otherwise have to be done in the springtime, when there is usually a rush to perform all the necessary plowing and preparation of the soil for planting. But if the soil is subject to erosion, then fall plowing cannot be done.

Air drainage, slope, and exposure are all affected by topography. Warren gives the following admirable statement regarding the effect of these factors on crop production:

> In one township in Wayne County, New York, the four-year average yield of apples was 43 bushels more per acre on easterly than on westerly slopes. The difference seems to be entirely due to the prevalence of strong west winds that blow off the apples.
>
> An elevation above the surrounding country is sometimes desirable for avoidance of frost. In the peach sections of Northern New Jersey, the valleys are best for grain crops but are not good for peaches, because the late spring frosts are so likely to kill the buds. The trees in the valleys bloom a little earlier. Frosts sometimes occur in the valleys when the higher land is exempt. Fungous diseases are also worse in the valleys than on the higher land that has good air drainage.
>
> If there is any danger from drought, side hills are much more affected than level land. Not only does much of the water run off, but the evaporation is usually more, particularly from the south and west slopes. In a region of fairly good rainfall, the hillsides are often really semiarid.[5]

c. *Soil fertility.* Success in farming is to no small extent determined by the fertility of the soil. In selecting a farm the mistake should not be made of choosing a soil that is *naturally* poor in fertility with the idea and hope that it may be made into a productive soil. This is usually a costly experiment. It is much better to buy a farm the soil of which is fertile. To be sure, the soil may be in poor condition, but if it is productive, it may be a good buy. An estimate of natural fertility may be made in several ways. One of the simplest and most effective way is that of observing the type of weeds and plants which are at present growing on the farm. Davenport, in his book, *The Farm,* describes this in the following manner: [6]

---

[5] Warren, *Farm Management,* p. 520.

> Nature cannot keep a secret even when there is a skeleton in the closet and there are positive indications of fertility or the lack of it so clear that he who runs may read. If it is an old and long settled country, these evidences will be found in the buildings, fences, livestock, growing crops, schoolhouses, churches, the contents of merchants' stores, local societies, and enterprises in general. Indeed, it can almost be scented in the atmosphere which literally drips with prosperity in some localities while in others it bespeaks a weary land.
>
> If the locality is recently settled, the observer may be forced to draw his own conclusions not from crops but from spontaneous growth with which nature clothes all soils, good or poor. Here he is not without a guide to safe conclusions, though he must be on guard as to climatic influences, especially moisture. Every region has its characteristic natural growth with which the land judge should first become acquainted. As the author's knowledge of world conditions is limited, the examples given must be taken as illustrative rather than comprehensive.
>
> On timberland, certain trees indicate good soil as certain others speak of its poverty. For example, elm, black walnut, burr oak, linden, tulip tree, and sycamore indicate good soil. Beech, in the northern states at least, means a light but productive soil as truly as sassafras and scrub oak indicate one that is thin. Maple, like white pine, is non-committal for they both grow on almost every kind of soil from clay to sand and from moist to dry, though pine thrives best on light dry lands. In general, conifers succeed better than deciduous trees in deep sand or on land defective in moisture because the evaporation from the leaf surface is far less, sometimes stated as only one-tenth as much. For this reason, a growth principally of conifers indicates comparative dryness, either from lack of rainfall or from a leachy soil. Small scrubby growth indicates either a poor soil or a deficiency in moisture which means again that the amount of rainfall should always be borne in mind in judging lands.

---

[6] Davenport, *The Farm,* pp. 71–73.

TABLE 79

SUMMARY OF SOIL TYPES, THEIR DESCRIPTION, CROP ADAPTABILITY, NORMAL YIELDS, AND SELLING PRICES[a]

Soil Type	*Description*	*General*	*Special*	*Yields per Acre*	*Range in Price*[b]	*Relative Values*[c]
Norfolk fine sandy loam.	1–3 inches of gray to dark gray loam; fine sand underlaid by yellowish fine sandy loam, 10–15 inches deep; subsoil is yellowish friable fine sandy clay.	Peanuts Cotton Corn	Potatoes Garden Fruit	Peanuts 1,100 to 2,500 lb. Cotton ⅓ to 1 bale. Corn 15 to 35 bu.	$30–$100	100
Norfolk fine sandy loam (deep phase).	Same as above except deeper surface soil.	Same	Same	Slightly lower	Slightly lower	85
Norfolk loamy fine sand.	2–4 inches of gray fine sand underlaid by yellowish fine sand to 25–35 inches; subsoil is yellow fine sandy loam to sandy clay.	Corn Peanuts Cotton	Vegetables Potatoes	Corn 10 to 25 bu. Peanuts 800 to 1,600 lb. Cotton ¼ to ½ bale.	....	68
Marlboro very fine sandy loam.	1–3 inches of gray to brownish-gray very fine sandy loam underlaid by 6–10 in. of heavy yellowish very fine sandy loam; subsoil is yellowish heavy fine sandy clay.	Cotton Corn Peanuts	Vegetables Fruit Hay	Cotton ½ to 1½ bale Corn 15 to 40 bu. Peanuts 1,500 to 3,000 lb.	$40–$125	128

TABLE 79—(Continued)

Marlboro fine sandy loam.	5–8 inches of yellow to brownish-gray fine sandy loam with a heavy deep yellow fine sandy clay subsoil.	Cotton Corn Peanuts	Vegetables	Cotton ½ to 1 bale Corn 15 to 40 bu. Peanuts 1,100 to 3,000 lb.	$50–$125	121
Ruston fine sandy loam.	4–7 inches of grayish-brown to light gray fine sandy loam with a reddish-brown to yellow fine sandy clay subsoil.	Cotton Peanuts Corn	Vegetables Fruit	Cotton ½ to 1½ bale Corn 18 to 40 bu. Peanuts 1,200 to 2,800 lb.	$30–$100	115
Ruston sandy loam	6–8 inches of gray or grayish-brown loose sandy loam with a yellow to red friable sandy clay subsoil.	Cotton Corn Peanuts	....	Cotton ⅓ to 1 bale. Corn 15 to 30 bu. Peanuts 1,100 to 2,000 lb.	$20–$80	86
Orangeburg sandy loam.	2–4 inches of gray to brownish-gray loamy sand underlaid by 20–30 inches of yellowish loamy sand; subsoil is a bright red friable sandy clay.	Cotton Corn Peanuts	Hay Grain	Cotton ½ to 1½ bale. Corn 20 to 40 bu. Peanuts 1,500 to 3,000 lb.	$40–$100	126
Greenville fine sandy loam.	6–10 inches of red or brown fine sandy loam with a red heavy friable fine sandy clay.	Cotton Corn Peanuts	Grain Clover	Cotton 1 to 2 bales. Corn 20 to 50 bu. Peanuts 1,800 to 3,000 lb.	$100 or more	176
Cuthbert fine sandy loam.	1–2 inches of gray light fine sandy loam underlaid by 10–15 inches of yellowish heavy fine sandy loam; subsoil is a compact reddish-yellow clay.	Cotton Corn Peanuts	Vegetables Fruit	Cotton ¼ to 1 bale. Corn 15 to 40 bu. Peanuts 800 to 2,400 lb.	$25–$100	97

---

[a] Soil Survey of Northampton County, North Carolina, U. S. Department of Agriculture, 1925, No. 9

[b] Depending on location with respect to roads and towns and upon the extent of improvement.

[c] Calculated as index numbers based on reported yields and ranges in value. Norfolk fine sandy loam taken as the basis or 100.

TABLE 79—(Continued)

SUMMARY OF SOIL TYPES, THEIR DESCRIPTION, CROP ADAPTABILITY, NORMAL YIELDS, AND SELLING PRICES[a]

Soil Type	*Description*	*General*	*Special*	*Yields per Acre*	*Range in Price*[b]	*Relative Values*[c]
Dunbar very fine sandy loam.	2–4 inches of dark gray to grayish-brown very fine sandy loam underlaid by 8–10 inches of yellowish heavy fine sandy loam; subsoil is a yellowish-red sandy clay.	Cotton Corn Peanuts	Potatoes Vegetables Fruit	Cotton $\frac{1}{3}$ to 1 bale Corn 12 to 35 bu. Peanuts 600 to 2,000 lb.	$25–$100	92
Lufkin very fine sandy loam.	6–8 inches of grayish to yellow fine sandy loam with a subsoil of heavy tough compact clay, yellowish to brownish-yellow in color.	Cotton Corn Peanuts	Clover Fruit Vegetables	Cotton $\frac{1}{4}$ to 1 bale Corn 10 to 35 bu. Peanuts 1,000 to 2,500 lb.	$15–$125 $75 average	102
Coxville very fine sandy loam.	4–6 inches of light gray to ash gray very fine sandy loam with a plastic clay subsoil, mottled red, yellow, and brown.	Corn Cotton Peanuts	Clover	Corn 15 to 35 bu. Cotton $\frac{1}{3}$ to 1 bale. Peanuts 1,000 to 2,400 lb.	$10–$100	93
Wickham loam. .	2–4 inches of dark brown loam underlaid by 3–5 inches of brown heavy loam; subsoil is a reddish heavy friable clay.	Cotton Corn	. . . .	Cotton $\frac{1}{2}$ to $1\frac{1}{2}$ bale Corn 20 to 40 bu.	. . . .	135

TABLE 79—(Concluded)

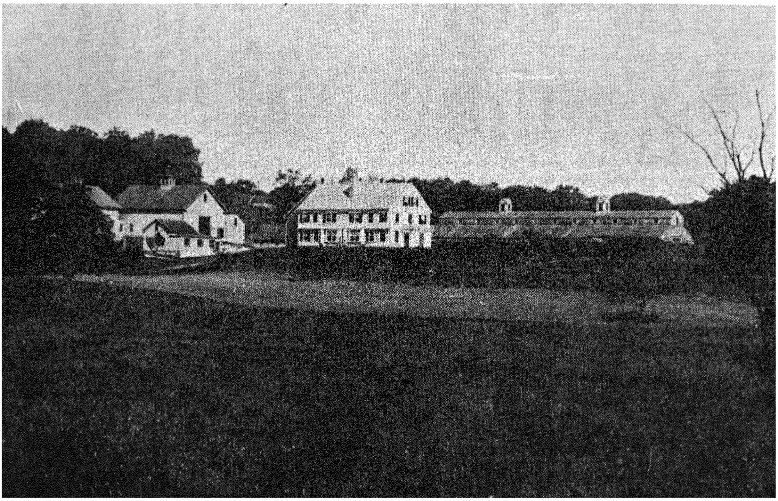
Cecil fine sandy loam.	6–8 inches of light or brownish-yellow fine sandy loam with a heavy reddish clay subsoil, brittle and friable, sometimes mottled.	Cotton Corn Grain	Fruit Hay	Cotton less than $\frac{1}{2}$ bale Corn 10 to 25 bu.	**$20–$50**	**60**
Cecil clay loam.	5–7 inches of brownish heavy clay loam with a red heavy stiff clay subsoil.	Corn Cotton Grains	Potatoes Vegetables Apples	Corn 10 to 25 bu. Cotton $\frac{1}{4}$ to $\frac{3}{4}$ bale Wheat 6 to 12 bu.	**$20–$60**	**67**
Appling fine sandy loam.	1–3 inches of gray fine sandy loam underlaid by 3–5 inches of yellowish heavy fine sandy loam; subsoil is a reddish-yellow fine sandy clay.	Cotton Grains	....	Cotton $\frac{1}{3}$ to $\frac{2}{3}$ bale Wheat 8 to 12 bu.	**$20–$60**	**67**
Bradely sandy loam.	2–3 inches of gray loamy sand underlaid by 8–30 inches of yellowish-gray sandy loam with a red clay subsoil.	Cotton Corn	....	Cotton $\frac{1}{4}$ to $\frac{1}{2}$ bale Corn 10 to 20 bu.	**$10–$50**	**52**

---

[a] Soil Survey of Northampton County, North Carolina, U. S. Department of Agriculture, 1925, No. 9.
[b] Depending on location with respect to roads and towns and upon the extent of improvement.
[c] Calculated as index numbers based on reported yields and ranges in value. Norfolk fine sandy loam taken as the basis or 100.

What is true of timber is equally true of grass and weeds. For example, Kentucky blue grass indicates a strong soil, while redtop will grow either on moist clay or in dry poor sand, though with far less luxuriance. A natural growth of leguminous plants indicates plenty of mineral and possibly as yet an uncompleted soil as may often be found along a mountain side. Such vagabond weeds as dandelion and ragweed will grow on almost any soil, although, like their betters and like all forms of cosmopolitan growth, they thrive best on good land. On the other hand, purslane, commonly called pusley, is a strong feeder and, so far as the author knows, is found only on good or at least productive soils.

Another method open to the prospective purchaser is to study the crop history of the farm, if such is available, through records or by interviews with the present or former owner. By crop history is meant the crops that have been grown on the different fields, the yields which have been obtained, and the treatment which the soil has received.



Courtesy of N. C. Dept. of Agr.

Fig. 44. A farm with elaborate and expensive buildings should not be purchased if the operator expects to pay for the farm out of farm income.

A soil survey, if one is available, usually gives a description of the various soils, their productivity, crop adaptation, and price. Information of this type is very valuable indeed. Table 79 indicates the type of material which may be obtained from a soil survey.

d. *Farm layout.* In buying a farm, it is desirable to give some attention to the size, shape, and arrangement of the fields and location of the buildings. As suggested in connection with distribution of the land area, the layout may be best determined by making a map of the farm showing the field lines, ditches, streams, and other natural or artificial characteristics. On such a map also may be designated the type of soil that is found in each field. Thought should be given to the possibility of rearranging the layout, if such seems to be desirable. Normally, in a good layout the fields should be large and uniform in shape, and the soil type, as far as possible, should be uniform in each field. (See Chapter XIV.)

Courtesy of N. C. Dept. of Agr.

Fig. 45. The location of a farm with respect to highways and markets is an important factor to consider when buying or renting a farm.

e. *Condition of the improvements.* A survey should be made of the buildings on the farm, the fences, and the drainage system. This should be done in an orderly and systematic manner so that no detail is overlooked. Each building, for example, should be studied individually and notes should be taken on the condition of the interior as well as of the exterior, stressing such items as condition of the roof, foundations, chimneys, flues, condition of the basement, the drainage, and the like.

f. *Water supply.* The value of the farm often depends on the character and availability of the water supply. This applies not only to the wells, which should be sanitary and conveniently located, but also to the streams and their condition throughout the year. Information should be obtained on whether or not the streams dry up during the summer, or whether or not they are likely to do serious damage during the fall and spring. This may be obtained in part through observation and in part through information from neighbors and others who are familiar with the farm.

In those areas where water is used for irrigation, the nature and character of the water supply should be given careful consideration. Considerable difficulty has been experienced in irrigation sections relative to the legal aspects of the water supply. With respect to this subject Ely and Morehouse make the following comment: [7]

> Here is one of the most complex phases of property rights. The complexities arise from the fact that rights of individuals differ so much from State to State, and from the fact that the rights of States, of the national government, and of the individuals who obtained land from the national government are conflicting. Another complicating feature is the fact that the people who came into the West from humid areas did not appreciate the changed conditions of life. In the humid regions water was plentiful, almost a free good, and riparian rights were developed with this in view. When the settlers came into the arid West, they found that water was no longer plentiful; it had to be economized and recognized as a form of property. In fact, to these settlers water became another factor in production.

g. *Location of the farm.* A factor of no mean significance is the location of the farm with respect to markets, schools, churches, and improved roads. Farms that are located long distances from markets, or those located on roads that are not maintained, should be discounted heavily. Poor roads and long distances add greatly to the cost of marketing and, hence, tend to decrease the net income which may be attributed to the farm. Location near good schools and churches is always desirable.

---

[7] Ely, R. T., and Morehouse, E. W., *Elements of Land Economics.* New York: Macmillan, 1926, pp. 160–161.

3. Personal Considerations Affecting Purchase or Rental

The personal considerations affecting the choice as between purchase or rental fall into two main classes: (a) Personal experience and ability, and (b) personal desires. The responsibilities connected with farm ownership and operation call for training and experience in farming and in business. Data from the Fourteenth Census show that approximately 41.6 per cent of the owners had no farm experience other than as owners, but the average farmer in this group was 30.8 years of age when he began farming. About 20.5 per cent of the owners began farming at 22 years of age but were farm laborers 5.8 years and tenants 8 years. Thus they were 36 years of age when they became owners. Another group consisting of 23.7 per cent of all owners began farming at 25.1 years of age. These were tenants 8.4 years and became owners at 33.5 years of age. About 14.1 per cent of the owners began farming at 24.8 years of age. These were farm laborers 6.8 years and became owners at 31.6 years of age.

Unfortunately, data are not available on the relative success of the various groups. However, to judge from the results obtained from studies of farm owners in the United States, experience is a valuable prerequisite to ownership.

> Occasionally [says Warren], a man makes a fair success when he has no particular qualifications except muscle, but success under this condition is much more difficult than formerly. Occasionally a good executive makes a fair success when he does no manual work, but higher profits are usually made by those who combine executive ability with labor. Some very successful men have very little mechanical ability, while a good mechanic may fail. Sometimes the mechanical genius spends so much time puttering with his tools that he does not get time to use them in raising crops. Good common sense, which is another definition for business ability, is the most important trait, but the highest profits are made by those who combine this ability with experience, scientific

knowledge of plant and animal production, manual and mechanical skill, and hard work.[8]

A second group of personal considerations may be classed as personal desires. Many prospective operators will want to try new methods and new techniques which call for complete freedom of action and control of the land. It is not hard to visualize how the retired landowner might be reluctant to follow any procedure other than that which had proved profitable to him, and how the young ambitious farmers might be filled with plans and be anxious to put them into practice. Another aspect is the feeling of independence which comes with ownership and also the spirit with which the farmer sets out to "make good" when only his own fate is at stake.

4. Farm Appraisal

After a prospective owner has taken all of the above-mentioned factors into consideration, it will be advisable for him to record in a systematic manner all the important points concerning the farm. Such a record will be of material assistance in making a correct appraisal of the farm or estimate of its value. That is, it will enable the prospective owner to evaluate correctly the advantages and disadvantages of the farm.

If an appraisal is made of two or more farms, the various important factors which affect choice will be made much clearer by contrast. The use of an appraisal blank, or of a farm score pad, is suggested as a means of doing this. A sample appraisal blank, properly filled out, is shown in Table 80.

The appraisal should include a careful survey of the land. All land should be classified as to both present and potential use. Any subdivision of land is, of course, arbitrary. The division shown in Table 80 takes account of all crop land, dividing it into three grades, on the basis of fertility,

---

[8] Warren, *op. cit.*, p. 13.

TABLE 80

SAMPLE APPRAISAL BLANK FOR FARMS

Farm	"A"		"B"	
Location	Maspeth, N. C., Route #3, (4 miles West)		Maspeth, N. C., Route #1, (4½ miles East)	
Description:				
Land	145 acres		145 acres	
Crop land[a]	52 acres		51 acres	
Grade A	26 acres at $100	$2,600	4 acres at $100	$ 400
Grade B	19 acres at 75	1,425	32 acres at 75	2,400
Grade C	7 acres at 50	350	15 acres at 50	750
Pasture	25 acres		19 acres	
Tillable	13 acres		10 acres	
Rotated	8 acres at $ 65	520	6 acres at $55	330
Permanent	5 acres at 40	200	4 acres at 40	160
Wooded	12 acres at 30	360	9 acres at 25	225
Woodland	60 acres at $20	1,200	61 acres at $18	1,098
Idle land	5 acres at 10	50	10 acres at 10	100
Farmstead, roads, etc.	3 acres at 5	15	4 acres at 5	20
Buildings, etc.	One 6-room house in good condition	$2,400	One 7-room house in fair condition, bad roof	$1,800
Dwelling	Whitewashed good condition	500	Unpainted, needs roof	300
Tenant houses	Two tenant houses, unpainted, but in good shape	1.600	One tenant house unpainted, also has rotting foundation	1,200
Tobacco barns	2 slightly faulty flues	200	2 flues need replacing	150
Other buildings	Garage, crib, smokehouse, shed	175	Crib, hog house, smokehouse	100
Fences	In fair shape	40	Need many new posts	25
Wells	3 deep wells, tiled	75	4 wells, 2 tiled, others need repair	60

TABLE 80—(Continued)

Farm layout:		
Size of fields	4 rather large, 3 medium, and 4 small	2 15-acre fields, 10 small, and 2 very small
Shape of fields	5 regular, 2 fairly good, and 4 poorly shaped	2 fairly good, 4 average, and 8 poorly shaped
Arrangement	Good—farmstead about in center	Rather poor—farmstead on one side
Possibility of improvement	Possible with moderate outlay—no serious handicaps	Two deep ditches and poor location of farmstead make it inadvisable
Transportation:		
Type of road	Graveled surface	Graded
Distance to hard surface	¼ mile	½ mile
Character of neighborhood	Good	Fair
Educational	Consolidated School 1 mile	Graded School 2 miles, High School 4½ miles
Religious	2 active churches within 2 miles	1 active church 1½ miles
Labor supply	Fairly good	Doubtful
Remarks	Creek runs through corner of pasture and into woodland. Pastures are good. Farm has been in hands of same farmer for 20 years. $200 paid in taxes last year. Farm has a good reputation in the town and community. Woodland seems well timbered.	Farm has changed hands twice in last five years, reputation doubtful. $175 paid in taxes last year. Pastures might become scanty in dry years—rather low water supply. Considerable valuable timber seems to have been removed recently. Soils and improvements appear to have been carelessly used.
Price asked	$15,000	$13,000
Estimated worth	12,500	9.500

---

[a] Based on natural fertility, general condition, drainage, topography, and alleged yields.

drainage, topography, soil type, and uniformity. Pasture land, woodland, idle land, and land occupied by buildings, roads, and lanes are also considered. The values attached to the various classes of land are estimates based upon land prices in the community, or made from capitalizing the estimated net incomes.[9]

All buildings, fences, wells, and other improvements must be carefully inspected, and an estimate must be made of their value. These estimates may be based either on replacement cost minus depreciation or upon the capitalized annual net worth to the farm business. The former method is simpler and more often used.

On any farm there are a number of factors, such as farm layout, transportation facilities, character of the neighborhood, nearness to schools and churches, which do not lend themselves to monetary evaluation. Nevertheless, they carry considerable weight in determining choice. In order that proper account will be taken of them when the final decision is made, these should be described or listed when the appraisal is made.

The completed appraisal gives the buyer a firm basis for his purchase price. Since such offers are usually made in round numbers, an arbitrary value has been attached to the "intangible assets" in Table 80. For Farm "A" the estimated or appraised value of all land, buildings, and tangible improvements totaled $11,710, but to this was added $790 for the advantages offered by the neighborhood, the general character of the farm, the transportation facilities, and the layout of the farm. The total appraised worth, then, totaled $12,500. For Farm "B" the tangibles totaled $9,118, and the intangibles, $382, giving a grand total of $9,500. These figures may be compared with the prices asked for the farm to determine the nature of the "bargain." If the appraised worth of the farm differs to any great amount from the price asked, a thorough investigation should be made to determine the cause. Unless the seller has an extremely urgent reason for disposing of the farm, the price asked will ordinarily be somewhat in excess of its worth based on income-producing power.

---

[9] See Chapter VIII on standard farm organization as a method of determining the farm income.

5. Legal Aspects of Buying a Farm

Aside from the economic and the physical problems involved in buying a farm, there are several legal considerations which are extremely important, chief among which are the terms of sale, transfer of deed and title, and in cases where the purchase price is not paid in full, arrangements regarding taxes and special assessments.[10]

a. *Terms of sale.* In most cases farms are purchased on a "time" basis. When this is the case, the terms of sale usually provide for a cash payment which covers a part of the purchase price. The indebtedness, or the balance of the purchase price, may be liquidated by annual, semi-annual, or term payments. Each payment usually is composed of two parts, the principal and the interest. When the term payment scheme is used, the annual or semi-annual payment consists only of interest, and at the end of the term, say 5 or 10 years, the principal sum is paid. When the indebtedness, *i.e.*, the principal sum, is reduced annually or semi-annually, the indebtedness is said to be amortized.

There are two plans in use for the amortization of indebtedness. One of these provides for equal annual or semi-annual payment of the principal sum together with the interest on the balance of indebtedness. For example, on an indebtedness of $2,000 to be paid in 10 years, the annual principal payment would be $200; the semi-annual payment, $100. To this sum would be added the interest on the balance of the debt, which would be $100 for the first year if the interest rate was 5 per cent. Thus, the first annual payment would be $200 on the principal and $100 for interest, or $300. The second year, the principal would be

---

[10] See Chapters XXIV and XXV for legal aspect of renting a farm.

$200 but the interest would be 5 per cent on $1,800, or $90, and the total would be $290.[11]

The second or standard plan provides for equal annual or semi-annual payments which include both interest and principal. In the case of a $2,000 debt to be liquidated in 10 years, the annual payments would be $259.01, and if the payments are made semi-annually, then they would be $130.10.

The important thing is not so much the repayment plan as the period over which the remaining part of the purchase price or debt is to be paid. Should such a period be short, or long? That is, should the payment of the debt be paid over, say, 5 to 10 years or 30 to 40 years? A question of this kind cannot be answered with a simple yes or no. If the farm is purchased at the beginning of a period when the net income from farming is constantly increasing, it would be a wise thing to make the length of the payment period short, thus liquidating the loan before net farm incomes begin to decline. The repayment policy will be quite different if the farm is bought at the beginning or during a period of declining net farm income. In this case, the cash payment should be as large as possible and payment be extended over a long period. This scheme will make the debt less and the payment easier. The amount due each year should be in line with the expected net income from the farm.

Under stable conditions the length of the repayment period is of no great importance. It may be short or long, depending upon the alternative use of the funds. Suppose, for example, that a farmer can use the funds which might be used in liquidating his debt more profitably in expanding his farm business; then he should not liquidate the debt, but rather use this money to expand his business. But, on the other hand, if no profitable alternative use of the funds is available, then the debt ought to be liquidated. It is for these reasons that when the terms of sale are being discussed the farmer ought to insist that a provision be inserted in the sales contract providing for the liquidation of the whole debt at the end of a specified period at the option of the purchaser. Such a provision is included in all sales contracts used by the Federal Land Banks.

---

[11] This is often referred to as the "Springfield Plan."

b. *The deed and title.* Any purchaser of land should be sure that a clear title to the land is obtainable and should become familiar with any irregularities in the title. In order to be certain of this, it will be advisable to have an abstract of the title made. This should be done by a competent and reliable lawyer or abstracting firm. The abstracting of a title may prove complicated, particularly when the land has changed hands frequently, or has been mortgaged several times. Each time a mortgage is made, the title is transferred, new lands are acquired, or parts of the original land are sold, papers are filed showing the transaction. There should be records of all patents, attachments, court actions, legal decisions, and trust deeds made with respect to the land. The abstract will show whether each of these has been cleared up, how it was done. and the exact nature of the title to date.

When the transaction is relatively small, a complete abstract may prove too expensive. In such cases, a certificate of the title may be used in place of an abstract. Such a certificate is a statement that the title has been examined and has been found clear and valid, or has been found clouded in particular parts.[12]

The deed to land is a written instrument conveying at least a life interest in the land. A deed must be signed, witnessed, acknowledged, delivered, and recorded. The parties, that is, seller and buyer, must appear before an official designated by statute, usually a magistrate, a justice, or a notary public, and acknowledge the transaction to be their free act and deed. The deed should then be properly recorded.

---

[12] Adams, *Farm Management*, p. 80.

When mortgages are entered into, it is customary to call in a lawyer familiar with proceedings of such nature and to intrust him with the responsibilities. Quite often the firm which accepts the mortgage will have competent lawyers and by merely reading over the contract will assure the mortgagor of the absence of defects and discrepancies.

c. *Taxes.* Inquiry at the county tax collector's or tax assessor's office should clear up any doubt regarding taxes, that is, whether or not they have been paid up to date, and the amount of assessment. Although apparently trivial in nature, such preliminary precautions may prevent trouble later, and it is advisable to take these precautions before buying.

6. The Size of Farm to Acquire

As it is not always easy either to increase or to decrease the size of a farm, it is a wise precaution to acquire a farm of approximately the "right" size. By right size is meant that area which the operator can most effectively manage, or the area which he can operate at full capacity or at maximum net returns. To state it more specifically, the size of the farm acquired should fit the ability of the operator. Fitting the farm to the operator's ability, however, is not an easy thing to do. The farm operator may buy or rent a farm which, at a given time, appears to be the proper size, but which in the course of time may become either too small or too large. That is, in the course of time, the ability of the operator or economic conditions have changed. In selecting a farm, therefore, it is wise to buy or acquire a farm which will be the "right" size when the operator has reached his maximum ability as a farm manager. It would be much better if the size of the farm could be increased gradually with the growth in ability, but this is not always possible.[13]

---

[13] This difficulty may be avoided by the operator's renting a farm for a few years for the purpose of determining what the "right" size really is.

Questions

1. Why is the selection of the farm a difficult and important task?

2. Explain the factor which tends to make the task a complex one.

3. Under what conditions should temporary rental be preferred to purchase?

4. Why was 1919 a bad time for purchase?

5. Would you advise purchase of a farm in 1933? Explain.

6. List the important physical factor influencing the choice of a farm.

7. Of what value is a farm appraisal?

8. What legal considerations are involved in buying a farm?

References

App, Frank, and Waller, Allen G., *Farm Economics.* Philadelphia: Lippincott, 1938, Chapter X.
Adams, R. L., *Farm Management.* New York: McGraw-Hill, 1921, Chapter IV.
Boss, Andrew, *Farm Management.* New York: Lyons and Carnahan, 1923, Chapter V.
Davenport, Eugene, *The Farm.* New York: Macmillan, 1927.
Hunt, T. F., *How to Choose a Farm.* New York: Macmillan, 1906.
Warren, G. F., *Farm Management.* New York: Macmillan, 1916, Chapter 19.
U. S. Department of Agriculture, *Farmers' Bulletin 1088,* "Selecting a Farm," by E. H. Thompson, 1920.

CHAPTER XVII

Selection of Farm Machinery and Power

THE problem of selection and acquisition of the minor implements and tools is not a serious one. These tools are generally considered necessary on any farm, and are selected and bought as a matter of course. With the more complicated and expensive machinery, however, the problem of selection and acquisition is important.

The influences determining the desirability of a given machine evolve themselves into two important groups: the first is concerned with the factors governing the choice of the machine, and the second, with the resulting economy in labor, time, and effect on yields. The farmer must determine *what* to buy and, then, whether or not it will pay him to buy it. The distinction between these two is not always clearly defined. For example, the size of farm is a factor in both instances. The farmer may have selected for purchase the smallest combine available, yet when he calculates the relative cost of harvesting with and without the combine, he may find that his farm is too small to make the use of a combine profitable.

1. Factors Affecting the Selection of Machinery

The factors normally governing selection of implements and machinery are type of farming, topography, type of soil, size of farm, kind of labor available, extent of use in local area, and personal factors. The influence of the type of farming is obvious. The cotton farmer will not normally want a grain drill; nor the wheat farmer, a stalk cutter. The cotton farmer in Western Texas will not need a cotton planter with an attachment for distributing fertilizer nor a combination corn and cotton planter. The dairy farmer will need milking machines. Other examples will readily occur to the reader.

The influence of topography is almost as obvious. The side-hill plow will be suited to rolling conditions; and the nonreversible mold board, for level lands. No terracing equipment will be needed for farms with level topography.

Soil conditions determine the selection of plows, harrows, cultivators, and heavy machinery. A farmer in the Black Prairie Region in Texas will need a heavier plow than the farmer in the light, sandy soils of Southern Georgia; and the farmer in the Great Plains of the West, a different plow from the farmer in the rocky soils of New England.

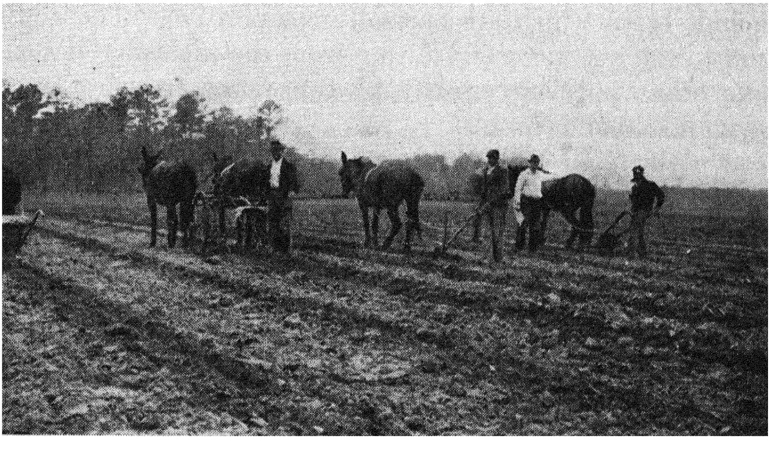
Size of farm is a determining factor, since one farm will have only one or two horses, whereas another will have six or eight. One farm will have large fields; and another, small fields. One farm will require that 10 acres be plowed in a day as compared with another on which 10 acres may be the total tillable acres and on which time is not an important element.

The amount of labor normally available will affect the type of machinery and tools used. Before selecting the machine, therefore, the farmer should be certain that the labor will be able efficiently to operate and care for it. For some of the newest machines expert technical knowledge is required for proper operation, care, and repair. Somewhat along the same line is the extent to which the machinery is used in the area. The experience of other farmers may serve as an excellent index of the practicability of selection. Farm laborers will be accustomed to a type of equipment and will usually do better with this type than with new types.

Another consideration is the availability of repair service or replacement parts at the local trading center. Valuable time may be lost if it is necessary to send to the factory for new parts. The farmer should also consider how well the machine is established or perfected; that is, are new improvements to be made, or will certain parts be improved to such an extent that parts for the old machine will cease to be manufactured? A good principle is to be sure that the machine will be profitable throughout its normal period of usefulness.

2. How to Select a Machine

Machines on the farm are often called labor-saving devices. That is, they are intended to replace man labor or to increase the capacity of each unit of man labor. From this point of view, the farm operator has merely to calculate what it costs to do a given operation when it is done with machinery and compare this cost with the cost when man labor is used. The results will indicate whether or not purchase is advisable. There are, however, several other things to be considered: first, the timeliness of performing farm operations, and second, the degree of diversification



Courtesy of N. C. Dept. of Agr.

Fig. 46. The selection of machinery is a difficult problem. Note the implements used in four different operations in the planting of corn.

allowed. Examples of the importance of timeliness are numerous. Late frosts may impede or delay the planting program. The harvesting period of some crops is so short and critical that any interruption, although short, may be disastrous. The period of cultivation, because of weather conditions, may be so shortened in the case of some crops that weed infestation, unless cultivation can be done quickly when soil conditions permit, will reduce the yield materially. In such cases, the use of a machine might be advantageous in spite of the fact that man labor with simpler tools might perform the operation at a lower cost. In the second case, the use of machines may so shorten the time required for a certain crop that the cropping plan may be revised to include crops which are normally competitive. The addition to the net income resulting from the inclusion of such enterprises must necessarily be considered in selecting a given machine or tool.

a. *Selection of cultivators.* The problem of selection is so complex that usually no simple solution is possible. In many cases it will be more advisable to consult some neighbor who has such a machine and to make a study of his experience rather than attempt to calculate the probable results for purchase and use. However, a few illustrations will show how a farmer may calculate the comparative costs of using labor and machinery or of using one type of machinery as compared with some other type.

Let us take the case of a cotton farmer who has 10 acres of cotton. He is equipped with 1-horse cultivators and is contemplating the purchase of 2-horse or 4-horse cultivators.

a. Current costs for the 1-horse cultivator:

Depreciation on cultivator (10% on $9.00)	$ .90	
Interest on average investment (6% on $4.50)	.27	
Estimated housing, taxes, and repairs	1.00	
250 hours man labor at $ .125	31.25	
250 hours horse labor at $ .125	31.25	
Total	$64.67	(Per acre—$6.467)

b. Costs for a 2-horse cultivator, assuming the operation takes the same time:

Depreciation (10% on $56.00)	$ 5.60	
Interest on average investment (6% on $28.00)	1.68	
Estimated housing, taxes, and repairs	5.00	
125 hours man labor at $ .125	15.63	
250 hours mule labor at $ .125	31.25	
Total	$59.16	(Per acre—$5.916)

c. Costs for a 4-horse cultivator:

Depreciation (10% on $115.00)	$11.50	
Interest on average investment (6% on $57.50)	3.45	
Estimated housing, taxes, and repairs	10.00	
63 hours man labor at $ .125	7.88	
250 hours mule labor at $ .125	31.25	
Total	$64.08	(Per acre—$6.408)

This analysis indicates a total saving of $5.51 in favor of the 2-horse cultivator. Now let us assume that the farmer also has 10 acres of corn which require one half as much man and horse labor as the cotton. The respective total costs become $95.92 for the present equipment, $82.60 for the 2-horse, and $83.65 for the 4-horse. The operating costs for corn and cotton vary directly with the number of acres, $9.38 per acre for the 1-horse, $7.03 for the 2-horse, and $5.87 for the 4-horse, while overhead charges remain the same.

b. *Combine vs. binder and header.* To illustrate further, let us compare the costs of harvesting wheat with a combine, a header, and a binder.[1]

	Combine (10 ft.)	*Binder (7 ft.)*	*Header (12 ft.)*
Depreciation	$152.00	$22.50	$13.33
Interest	37.80	6.75	6.00
Total	$189.80	$29.25	$19.33
Operating charges per acre:			
Man labor	$ .41	$ 1.80	$ 1.40
Power	.60	.59	.41

---

[1] U. S. Department of Agriculture, *Technical Bulletin No. 70,* "The Combine-Harvester: Thresher in the Great Plains," by Reynoldson, Kifer, Martin, and Humpries, 1928, p. 33.

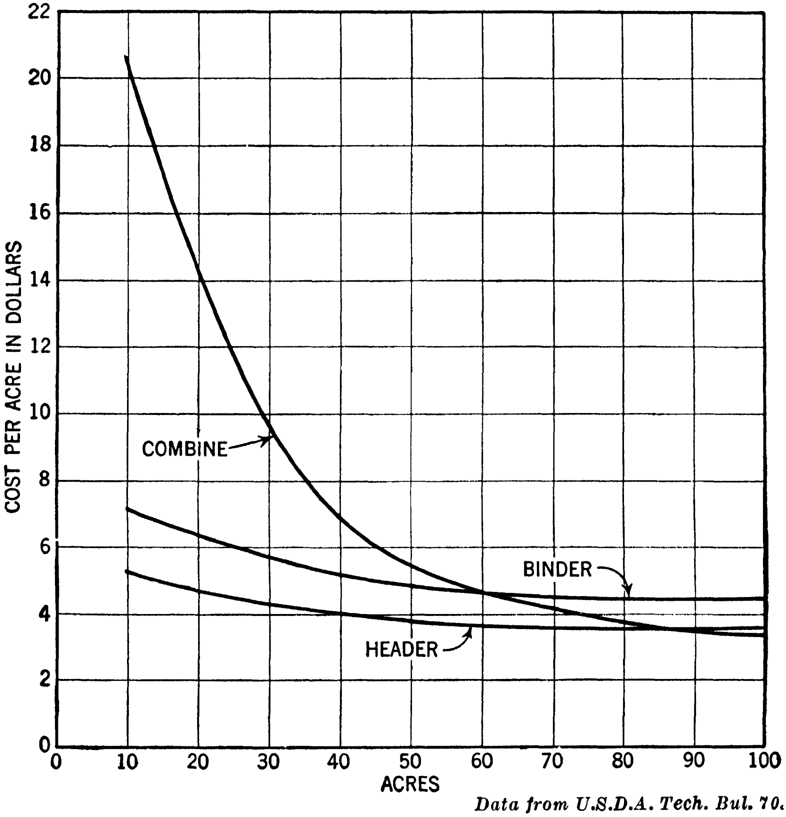
	Combine (10 ft.)	*Binder (7 ft.)*	*Header (12 ft.)*
Fuel, oil, etc.	.36	....	....
Twine	....	.28	...
Repairs	.10	.05	.05
Threshing	....	1.50	1.50
Total	$ 1.47	$ 4.22	$ 3.36

The estimated per acre costs for different acreages are as follows:

Acres	*Method*	*Interest and Depreciation*	*Operating*	*Total*	*Cost per Acre*
10	Combine	$189.80	$ 14.70	$204.50	$20.45
	Binder	29.25	42.20	71.45	7.15
	Header	19.33	33.60	52.93	5.29
50	Combine	189.80	73.50	263.30	5.27
	Binder	29.25	211.00	240.25	4.81
	Header	19.33	168.00	187.33	3.75
60	Combine	189.80	88.20	278.00	4.63
	Binder	29.25	253.20	282.45	4.71
	Header	19.33	201.60	220.93	3.68
80	Combine	189.80	117.60	307.40	3.82
	Binder	29.25	337.60	366.85	4.59
	Header	19.33	268.80	288.13	3.60
90	Combine	189.80	132.30	322.10	3.58
	Binder	29.25	379.80	409.05	4.55
	Header	19.33	302.40	321.73	3.57
100	Combine	189.80	147.00	336.80	3.37
	Binder	29.25	422.00	451.25	4.51
	Header	19.33	336.00	355.33	3.55

The lower cost per acre of using a combine offsets the additional investment as compared with the binder when about 60 acres are harvested, and as compared with the header when about 90 acres are harvested. In other words, unless about 100 acres of wheat are to be harvested, it would not be advisable to replace a header with a combine. (See Figure 47.)

The time factor enters into the problem, as was stated before, in a number of ways. In the first place, timeliness of performing operations has come to be considered important. There appears to be an optimum time, that is, optimum for highest yield, for almost all farm operations. Quite often this optimum period is relatively short, depending in most instances on weather conditions. With machinery of low capacity, it is often impossible to perform a given operation on an entire crop during this period.



Data from U.S.D.A. Tech. Bul. 70.

Fig. 47. In the harvesting of small grains the combine tends to compete with the binder and header only when the acreage harvested is large.

Ability to do this might increase the yield per acre to such an extent that machinery of a greater capacity would be justified despite a higher cost of performing the operation.

Unfortunately, no conclusive experiments have been completed along this line as yet, but practical illustrations are obvious: planting before insects become active, harvesting before rain, and destroying weeds at the right time.

On the other side of the problem, particularly in regard to the farm operator on the family farm, is the value of the time saved by machinery. Unless there is some other operation to be done, there seems to be no point in cultivating a crop in 3 days instead of 6, or of preparing the seed bed in 1 week instead of 2 weeks. The time saved would naturally increase the capacity of the operator. Additional land might be bought or rented, and the unit made larger. The possibility of doing this should be taken into consideration. If such an increase seems impossible, the question arises as to what value to attach to the labor saved. Reducing the value of this labor will reduce the savings resulting from the new machine.

Take, for example, the case of the cotton farmer who is comparing costs with the 1-horse and the 2-horse cultivator (see above). The only saving made is 125 hours of man labor. If the labor being used is all hired at 12.5 cents per hour, then the saving of $15.62 is correct; or, if there is some other operation equally profitable or approximately so, to which the saved labor of the operator can be applied at a rate of 12.5 cents per hour, the saving of $15.62 is correct; or if the operator values the added time allowed for leisure or for supervision at 12.5 cents per hour, the calculated savings are correct. The labor saved can in no case be valued at more than 12.5 cents per hour; otherwise, it would not have been applied to cotton in the first instance. Under ordinary conditions, on the average farm, some additional labor can be used with little, if any, decrease in efficiency. In this case then the value of the saved labor might fall to about 10.5 or 11 cents. The increase in yields due to timeliness alone might easily make up for this. Hence, despite the complexity of the problem, it is believed that the estimates made in the manner suggested will give, under normal conditions, a reliable answer to the question of whether to buy or not to buy.

3. Selecting the Type of Farm Power

The problem of selecting the type of farm power emerges whenever the farmer has a choice between tractor or animal power. When these two forms are available, which should the farmer use? Or, if both types are employed, how should they be combined on a given farm? These questions are not easily answered since the choice of power depends upon such things as the type of farm tasks, the size of the farm, topography of the farm, the farm layout, the effect of the forms of power on the soil, the cost of the power, prevailing economic conditions, the quality and quantity of the farm labor supply, and the age of the farmer, together with several other factors, which will be discussed briefly.

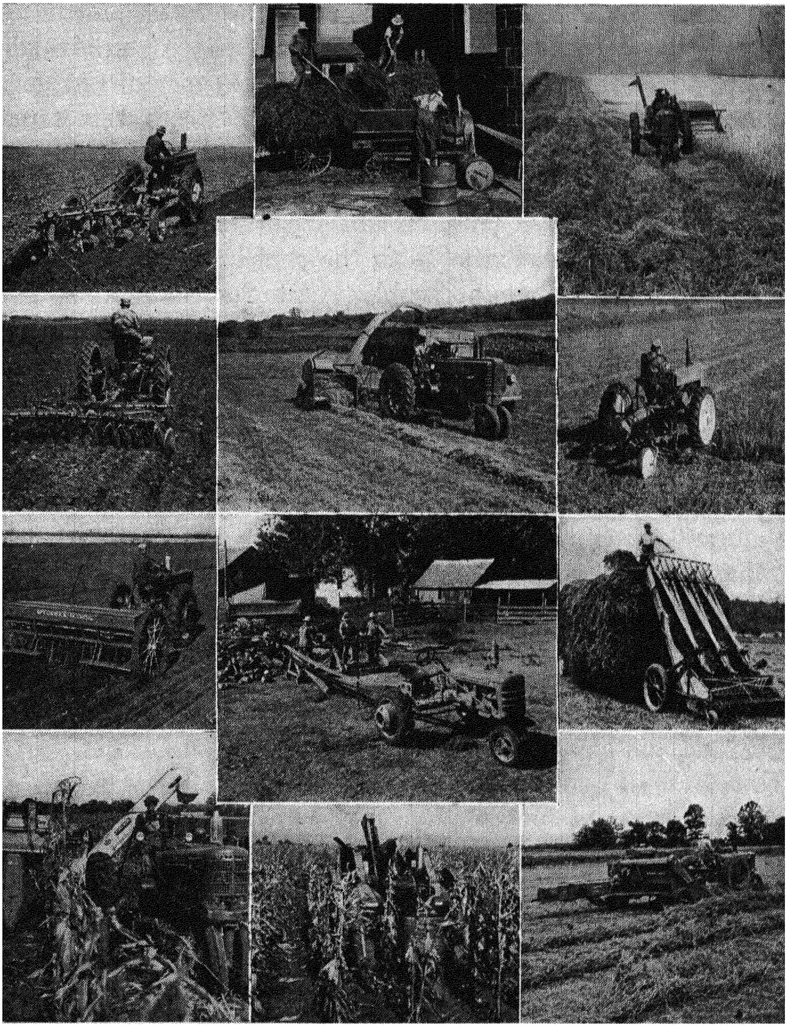
a. *The type of farm tasks.* "Tractors," states a recent report, "are used all over the United States but the highest degree of adoption is in the small grain areas, the Corn Belt, and specialized sections (farming areas) like the dairy, truck, and orchard areas of the Eastern and Western States."[2] The fundamental reason why the type of power varies with the type of farming is found in the variation in the farm tasks. It is well known that these tasks vary widely with the type of farming, and it is also well known that some tasks are much better adapted to one form of power than to another. From numerous studies which have been made, it seems clear that some tasks can be done faster and better with a tractor, whereas for others the choice favors horse power, and for others there is little difference between these two types of power. For example, the advantage of the tractor over horse power in terms of area covered in a 10-hour day is not so great for plowing and cultivating as for disking and harrowing. The reason for this is that as the load becomes lighter, the speed of the tractor becomes evident. For performing "slow-speed" tasks, such as plowing, the "normal" or necessary speed may be maintained by adding more horses. But in the "high-speed" operations, such as harrowing, the adding of more horses does not increase the speed of the operation, certainly not in proportion to the horses added. It is in these "high-speed" operations that the tractor has a decided advantage over horses.

---

[2] "Technology on the Farm," U.S.D.A., August 1940, p. 10.

Tractors may be preferred to horses when specified tasks must be done quickly. This is especially true of tasks which must be done during a limited time, such as seeding, spraying, or combining. For such tasks the tractor, because of its speed, may have a definite advantage over the slower-moving horse. On the other hand, for tasks which may be done at any time during the year or over a long period of time, and for which speed is not important, horses may be preferred. Again, for tasks which require the development of excessive power for short periods, horses may be used more effectively than tractors. This is based upon the fact that animals, such as horses, mules, or oxen, can develop more than normal power for short periods, whereas the power which may be developed by a tractor is limited. For certain tasks which require intermittent use of power, horses may be preferred to the tractor; this is especially true when short and frequent stops have to be made. Then too, there are some operations which are no longer done by animal power, such as those requiring belt work. Examples of these operations are baling hay and straw, grinding feed, silo-filling, and cutting wood. In some cases tractors are equipped with special attachments to do specific tasks, such as mowing, which have heretofore been done largely by animal power. It would not be necessary to buy a tractor simply to do these tasks, but if the decision between the use of tractor or horse power is a close one such tasks might decide the issue.

b. *The size of the farm.* The size of the farm is no longer an important factor in determining type of power to be used. The reason for this is that tractors are now available for practically all sizes of farms. Even small garden tractors are available. In spite of this adaptability of the tractor, occasions may arise when the choice of power may



Courtesy of International Harvester Company and John Deere Plow Company

Fig. 48. Today practically all farm operations can be performed by power equipment.

rest upon the size of the farm. The fact that horses or mules are at least as flexible as tractors, if not more so, gives the nod, as a rule, to animal power for the smaller farms. This has been found true in several studies in the use of power on farms. In most cases, tractor use increases with the size of the farm. For example, in a study made of the use of power on farms, for several types of farming, it was found that on the smaller farms 36 per cent were using tractors, whereas on the medium and large farms the percentage using tractors was 61 per cent and 89 per cent, respectively.[3] These data do not mean that on the small farms no problem exists as to the choice of power. They indicate simply that the problem becomes less acute as the size of the farm increases.

c. *Topography.* This factor, as the size of the farm, is no longer an important one in determining the type of power farmers use. Tractors have been so modified as to size and method of operation that they can be operated successfully on almost any type of terrain. But, even so, animal power may be better adapted to rough, hilly land than tractor power. This appears to be true on land that is so steep and the type and condition of the soil is such that "side slipping" is a problem when tractors are used. C. W. Gilbert found, in a study of tractors on New York farms, that rough, hilly land reduced the efficiency of the tractor because of loss of power, straining of the machines, and breakage of equipment.[4]

The effect of topography on the use of tractor power is shown by the geographic distribution of tractors on farms in the United States. The greater number are used in those areas characterized by level or gently rolling terrain, such as Illinois, Michigan, Indiana, and the West North-Central and West South-Central States. It should be pointed out, however, that the progress made in adapting the tractor to meet topographical conditions has been rapid. For example, the use of the tractor in the New England States, noted for its rough and hilly land, increased about 102 per cent between 1930 and 1940. This is the largest increase in tractors on farms of any section of the country, with the exception of the West South-Central, which shows an increase of 125 per cent in the tractors on farms during this ten-year period.[5]

---

[3] "Changes in Farm Power and Equipment," Works Progress Administration, National Research Project, p. 31.

[4] "An Economic Study of Tractors on New York Farms," by C. W. Gilbert, p. 71.

d. *The farm layout.* In many cases the type of power used will depend upon the farm layout. Small and irregular-shaped fields reduce the efficiency of any type of power, but this is especially true in the case of tractor power. The reason why this is true is that small and irregular-shaped fields consume relatively more time in turning than large, well-shaped fields. (See Chapter XIV.) And since horses or mules with light equipment can turn relatively more quickly than a tractor with heavy equipment, animal power is usually preferred when fields are small and irregular in shape. An equally important reason why animal power is preferred when the farm layout is bad is that the wasteland along the fencerows and headlands can be reduced to a minimum. However, the "power lift" has greatly facilitated the use of tractors under such conditions. This device permits the use of the tractor on short rows and small, irregular fields with about the same ease as animal power.

The importance of farm layout in the choice of farm power is clearly indicated by the actions of the farmers who have bought tractors. For example, in a study of farm tractors in Minnesota[6] "twelve per cent of the operators reported that they combined small fields in order to have fields large enough for economical tractor operations. Fifteen per cent reported changes in the shape of their fields. Three per cent of the operators reported clearing, stoning, or draining in order to straighten fields, remove obstacles, and make the land better adapted to tractor tillage." It is clear that where such changes cannot be made at all, or only at considerable expense, horse power would be preferred to tractor power.

---

[5] See also "Changes in Farm Power and Equipment," Works Progress Administration, p. 31.

[6] "The Farm Tractor in Minnesota." Minnesota Bulletin 280, p. 39.

e. *The cost of power.* There are two types of cost affecting the choice of power—the first or original cost, i.e., the investment, and the cost of operation. These two costs are interrelated. For example, the first cost of tractor power may be greater than for the horses needed to do the same work, but if the work can be done more cheaply with tractors than with horses, then the farmer may be justified in selecting tractor power. Or the reverse of this may be true, *i.e.*, the cheaper form (first cost) may be selected even if the cost of getting the farm work done (operating cost) may be greater. This is especially true if the farmer does not have the ability to buy the more expensive form of power.

TABLE 81

COST OF HORSE AND TRACTOR POWER [1]

Item of Cost	*Horse* [2]	*General-Purpose Tractor* [3]	
		1-plow	*3-plow*
Feed	$62.68	$ ——	$ ——
Fuel oil and grease	——	119.65	241.48
Labor	11.80	4.68	7.35
Repairs	——	13.55	19.15
Harness	1.60	——	——
Miscellaneous costs	.83	——	——
Depreciation	10.12	68.74	114.45
Interest	6.54	28.81	39.63
Taxes	3.49	15.37	21.13
Total	$97.06	$250.80	$443.19
Less credits (manure)	5.62	——	——
Net cost	$91.44	$250.80	$443.19
Average cost per hour	$ 0.112	$ 0.54	$ 0.60
Average cost per H.P.	0.112	0.06 [4]	$ 0.039
Cost per acre	3.85	1.94 [5]	——

---

[1] Research Bulletin 258, Iowa, June 1939.
[2] *Ibid.* Data for 1936.
[3] *Ibid.* Data for 1936 and 1937.
[4] Average cost on farms operated by horses only, 1936.
[5] All general-purpose tractors, 1936.

A more difficult problem is to determine which form of power to use when the cost of operation is used as a basis of selection. Most studies show that it is cheaper to maintain a horse than a tractor, but such data are not at all significant since a tractor, even a small one, may do much more work than a horse or mule. To make the costs of operating the various forms of power comparable they must be expressed in terms of a common denominator, such as cost per horse power, per hour, or per acre. For example, in a recent study[7] the cost of maintaining a horse for one year was $91.44, whereas the annual cost of operating a general-purpose 3-plow tractor was $443.19, or about five times that of a horse. (See Table 81.) From these annual cost figures, however, it cannot be assumed that horse power is cheaper than tractor power since one tractor is not necessarily comparable to one horse. When these costs are expressed in terms of a common denominator, however, they are comparable. In this case the cost per hour for horse power was $0.112 and for tractor power, $0.60. On this basis, the cost of tractor power was over five times the cost of horse power. But the hours used may not be an adequate common denominator. Suppose the costs are expressed in terms of horse power. On this basis the horse cost $0.112 and the tractor, $0.039; or the horse cost about three times as much as the tractor. Or, when costs are expressed on a per-acre basis, the tractor cost $1.94 and the horse, $3.85. In this case the horse power costs about twice the cost of tractor power.

It is clear that even when costs are expressed in terms of a common denominator they are not very useful in selecting the form of power. The reason for this is that the cost of power per unit depends on how extensively each type of power is used. Normally the per-unit cost will decline as the number of hours used or as the number of acres operated increases. In the case of one study[8] the cost of horse power declined from $2.30 per acre to $1.17 and the cost of tractor power declined from $2.25 to $1.47 as the size of the farm increased from 55 to over 335 acres, and the relative efficiency of horse power increased as the size of the farm increased.

---

[7] "The Cost and Utilization of Power and Labor on Iowa Farms," Research Bulletin 258, June 1939.

These facts show how the costs of horse and tractor power are affected by the length of time each is used, and this has a bearing on the selection of power. Suppose a farmer is considering the purchase of a tractor to replace or to supplement his horses. In this case he should be conscious of the fact that the cost of tractor power, as well as the cost of horse power, will be affected by the time they are used. If there is not enough work to keep the tractor busy most of the time, production costs may be excessive or higher than when horses are used exclusively. In a case of this kind it would be advisable to pay to have the tractor work done. In this way the farmer would avoid excessive production costs and at the same time secure any advantage that the tractor has over horses. Or, if a tractor cannot be hired, the farmer should consider the possibilities of increasing the size of his farm before buying a tractor and in this way minimize costs.

f. *The effect on land of various forms of power.* In some cases the choice of power may rest on the effects of each type on the soil. In some instances farmers have found that the tractor tends to pack the soil to a greater extent than horses.[9] The packing of the soil may be significant when a loose, friable seedbed is needed, *e.g.,* tobacco and truck crops. Packing will not be a serious problem where the soil is light, of good texture, and well-drained. However, both packing and puddling may occur when tractors are used on heavy, poorly drained soils.

g. *Prevailing economic conditions.* The choice of farm power may depend upon the farmer's income. It may not be desirable or even possible for a farmer to buy tractors when his income is below normal. The reason for this is found in the relatively low first cost of a horse or mule. There is some evidence that the farmer's use of tractors depends upon the income he receives. Information is available from 1916 to date on the number of farm tractors sold in the United States and the net cash income received by farmers. Although the number of tractors has increased and the number of mules and horses decreased over this period, the annual percentage change in the farm tractors sold is associated with the annual percentage change in the farmers' cash income. The number of tractors sold has usually increased when the farmers' cash income has increased, and has declined when farmers' cash income has declined. It should be pointed out, however, that tractors may be preferable to horses, even in years of low incomes, if by the use of tractor power the annual net income can be increased by lower production costs.[10]

---

[8] *Ibid.*

[9] "An Economic Study of Tractors on New York Farms," by C. W. Gilbert, p. 69.

h. *The labor supply.* The tractor is usually considered as a labor-saving device. This claim is substantiated by a number of independent studies of the use of tractors on farms. Schwantes and Pond found that Minnesota farmers using tractors were able to reduce the labor load by 67 days per farm. New York farmers, according to Myers, were able to reduce the labor needed by 2.4 months of man labor when tractors were used 295 hours or more per year for drawbar work. Others, such as Tolley, Church, Waller, and Gilbert, report the reduction of the labor load when tractors are used.[11]

The reduction in the use of man labor, however, would not, by itself, warrant the farmer's substituting tractor for horse power. In the event that labor is scarce and expensive, such as may be the case during a war or a period of industrial expansion, then the farmers may be justified, indeed compelled, to use labor-saving devices. But if labor is plentiful and cheap, the mere fact that the tractor will use less labor is of no great significance. Getting the work done on time may be a much more important factor than the saving of labor. Again, it is not alone the quantity of labor available which may affect the choice of power. It is the quality of the labor which apparently affects the use of tractors in some parts of the country. When labor is of poor and mediocre quality, horses or mules have been found most effective. Inefficient labor when used to operate a tractor will not only do a poor job, but will increase the repair bill. The breakage of equipment may also cause serious delays in getting the work done. In choosing, therefore, between tractor and horse power it is not alone the saving in labor that should be considered but whether or not the labor available can operate the tractor and tractor equipment efficiently.

---

[10] For an excellent discussion of this topic, see "Tractor and Horse Power," by C. M. Hampson and Paul Christophersen. South Dakota Exp. Sta. Circular 6, pp. 27–39.

[11] "Farm Tractors in Minnesota," Bulletin 280, pp. 40–41.

i. *The age of the operator.* The choice of power is affected by the age of the farmer. Older farmers, as a rule, prefer horses; younger farmers, tractors. This preference in the form of power has been indicated in a study by the Works Progress Administration.[12] In this study farmers under 40 years of age were adopting tractors much faster than farmers over 40. The obvious explanation of this is that younger farmers are more alert both mentally and physically and, therefore, can handle a tractor better than older men. It may also be true that the younger men have had more training in mechanics. This may be the result of the wide use of motorcars and the introduction of courses dealing with farm machinery in vocational schools.

j. *Miscellaneous considerations.* There are a number of things, other than those already discussed, that will affect the choice of power. One of these is the initial cost of the equipment required by each form of power. Normally the equipment needed to operate a tractor most effectively will cost more, indeed in some cases much more, than the equipment to use horse power effectively. Then too, the use of a tractor may require special equipment, such as extension rims, skid rings, lugs, and attachments to use "take off power." [13] True, the per-acre cost for the tractor equipment may be less than for horse equipment, but it is the initial investment that may influence the farmer more than the cost per acre in deciding which form of power to use.

---

[12] "Changes in Farm Power and Equipment," W.P.A., pp. 27–28.

The amount of custom work available may be a deciding factor in the choice of power. Some farmers who buy tractors plan to do tractor work of various kinds for pay, such as threshing, cutting wood, plowing, and combining. It is this custom work in some cases that makes the use of a tractor possible. When custom work is not available, or is limited, horses may be the cheaper form of power. This is especially true for farmers operating small farms. Gilbert found that 22 per cent of all tractor work was custom for farms of 79 acres or less, whereas for the large farms the the custom work was relatively less.[14] The amount of custom work available will depend also on the type of tasks to be done. For example, more custom work may be available in dairy regions than in areas devoted to fruit-growing,[15] because of the type of tasks and the time over which each task may be done. For example, silo-filling may be done over a longer period than the spraying of fruit trees.

The horse has several distinctive advantages over the tractor. The feed consumed by the horse may be, and to a large extent is, produced on the farm. This is not true of the tractor. The horses also supply manure which may be used in place of commercial fertilizer to produce crops. In these respects the horse may be considered not simply as a source of power but a complementary enterprise. These advantages, however, should not be overemphasized, since the horse must be fed whether working or idle, whereas the tractor consumes fuel and oil only when operated. Then too, the tractor is not subject to "baffling diseases or sudden death from overheating."[16] Although the tractor may not be subject to "baffling diseases," it is subject to breakdowns which are not only baffling to the farmer but waste his time and effort. This means that tractor service must be available at all times and at a reasonable cost.

---

[13] "Farm Tractors in Minnesota," Bulletin 280, pp. 58–59.

[14] "An Economic Study of Tractors on New York Farms," by C. W. Gilbert, p. 43.

[15] *Ibid.*

Questions

1. List the factors affecting the choice of farm machinery.
2. Why has the South been slow in using improved machinery?
3. Explain how the economy of using a given machine may be determined by the farmer.
4. Explain how purchase of a given machine may be inadvisable despite the fact that it would reduce man labor requirements considerably and would appear thus to be more economical.
5. State briefly the pros and cons of using tractor power.
6. What are some of the distinctive advantages of using horses as a source of power?

References

Adams, R. L., *Farm Management.* New York: McGraw-Hill, 1921, Chapter VIII.

App, Frank, and Waller, Allen G., *Farm Economics.* Philadelphia: Lippincott, 1938, Chapter VIII.

Hopkins, John A., *Elements of Farm Management.* New York: Prentice-Hall, 1938, Chapter XVI.

Warren, G. F., *Farm Management.* New York: Macmillan, 1916, Chapter 12.

Cornell University Agricultural Experiment Station Bulletin 506, "An Economic Study of Tractors on New York Farms," by C. W. Gilbert. 1930.

---

[16] "Changes in Farm Power and Equipment," W.P.A. National Research Project, p. 33.

Georgia State College of Agriculture Bulletin 428, Vol. XXI, "The Combine Harvester in Georgia," by H. E. Lacy and W. A. Minor. 1933.

Illinois Agricultural Experiment Station Bulletin 231, "The Horse and the Tractor," by W. F. Handschin, J. B. Andrews, and E. Rauchenstein. 1921.

International Harvester Company, *Muscles or Motors?* Chicago.

Iowa Agricultural Experiment Station Research Bulletin 258, "Cost and Utilization of Power and Labor on Iowa Farms," by Wylie D. Goodsell. June, 1939.

Minnesota Agricultural Experiment Station Bulletin 280, "The Farm Tractor in Minnesota," by A. J. Schwantes and G. A. Pond. 1931.

South Dakota Experiment Station Circular 6, "Tractor and Horse Power," by C. H. Hampson and Paul Christopherson. 1932.

U. S. Department of Agriculture, *Farmers' Bulletin 1565,* "Shall I Buy a Combine?" by L. A. Reynoldson. 1928.

West Virginia Experiment Station Bulletin 267, "Power on West Virginia Farms," by F. D. Cornell, Jr. 1935.

Works Progress Administration, *National Research Project Report A-9,* "Changes in Farm Power and Equipment," December, 1938.

CHAPTER XVIII

The Differential Nature of Management

SINCE the various problems of organization have been treated in the foregoing chapters and the subject should be well in mind, perhaps it can be used to provide a clearer concept of what is meant by management. The functions of the organizer as set forth in an earlier chapter (see Chapter IV) include all the necessary procedure prerequisite to the actual operation of a farm. The farmer, however, is a producer or a creator of utilities; thus setting up a plan of operation and providing the necessary resources are only preliminary duties. The task of management remains. Management means to direct, to administer, to carry out the plans of organization. The organizer must select the factors of production and determine how they shall be combined. He must also select the enterprises and determine how they shall be combined into a farming program. The manager must be sure that the methods and practices to be used in performing the various operations are the most efficient available; he must control and direct in detail the various factors of production; and he must note any major adjustments which should be made as a result of changing conditions. The organizer has provided for the purchase of resources and the sale of goods, and the manager has the direct job of buying and selling. The organizer has set up a system of records and accounts which the manager must keep from day to day.

1. The Functions of Management [1]

It is evident that the role of the manager presents a complex set of considerations. Without unnecessary details, the important ones may be set forth in an arbitrary manner. These may be called functions of management and may be stated as follows:

---

[1] Black, *Production Economics,* Chapter XIX.

a. Selecting methods and practices to be used in performing various operations.

b. Making more or less short time minor adjustments in the proportion of the factors of production and other parts of the farming program.

c. Controlling and directing the various resources.

d. Buying and selling.

e. Keeping records and accounts.

f. Seeing that the entire productive process proceeds smoothly from day to day throughout the year.

g. Reporting tentative adjustments in the factors of production which seem desirable because of price or market changes, savings of materials, utilization of waste or by-products, or new methods and practices, which the manager has been able to discover.

The first, fourth, and fifth functions, although not so much more important than the others as to justify separate treatment, are better defined and lend themselves to a broad discussion. These three will be treated separately in Chapter XIX.

The second function refers to the making of adjustments from day to day or from week to week—adjustments which should not be postponed, or adjustments of relatively minor importance. Weather conditions and unexpected price or cost changes are commonly the causes which give rise to such problems. A heavy rain may wash out recently applied fertilizer, making it necessary to use more than the allotted amount on a particular crop if the expected yield is to be realized. A sudden price change may make desirable a more or less intensive culture of a crop or the feeding of a class of livestock. A loss of some crop by insect damage may make it necessary to introduce a new but less profitable crop in order to utilize the land. Such short time adjustments and the responsibility for making them constitute one of the most important managerial functions.

In some ways, the third function is closely related to the one just discussed, in that if day-to-day adjustments are not necessary, the problem of control and direction will be less complicated. It may also be related to the problem of selecting methods and practices, that is, how operations are to be performed. For analytical purposes, however, it seems best to isolate this function for separate treatment. Labor is the factor or the resource requiring the most attention. Some writers have stated this function as the control and direction of labor. Doing this, however, seems to be going into detail too much, particularly since other factors are subject to control also, and would thus merit consideration. This function involves expert handling of the resources on the part of the manager so as to obtain the maximum production efficiency. As regards labor, the good will and cooperation of laborers are considered valuable assets, and the laborers should be controlled and directed in such a way as to retain this *esprit de corps*. Labor must also be directed in such a way as to expend the minimum amount of time and energy on any given operation. In the same way the various materials are subject to control and direction, and any savings in materials will make for greater efficiency.

As regards the sixth function, good management involves careful planning of the production processes so that they may all move forward smoothly without delays at any point. The various interdependent parts must be made to operate with a minimum of friction. In a factory, each department must be planned so that no other department will have to wait for it. On the farm, the departmental organization is not so clear-cut as in the factory, but there is some division. Operations requiring certain materials may be postponed because the manager has not the foresight to have these materials available at that particular time. The use of implements, machinery, and labor must be planned so that each operation may be performed at the proper time and without unnecessary delays.

The seventh function, referring to reports to be made by the manager, is one of the most important. It is conceivable that the organizer has made certain mistakes in planning the general program. In addition, changes in prices, methodology, and numerous other elements tend to make major adjustments necessary if the greatest returns are to be derived from the available resources year after year. Decisions to change the general policy of the organization, to change the enterprises and the proportion of the enterprises from year to year, or for longer periods, and the making of those adjustments which should be made fall within the scope of this function.

2. The Farmer as a Manager

This isolation of management as a distinct phase of the problem of farm operation runs the total of human agencies involved to three: organization, management, and labor. In one of the early chapters it was pointed out that in farming, in the majority of cases, ownership and management (management used in the narrower sense) are associated in one and the same individual. Similarly, organization, management, and labor are associated in one individual in the majority of cases. The 1930 Census reported that 56.7 per cent of the farms in the United States were operated by full owners, which means that these individuals performed the functions of organization and management and also furnished a large part of the labor supply. Only 0.889 per cent of the farms were operated by hired managers, the only classification in which three individuals joined in performing all human functions. The remaining farms were operated by tenants. On these farms the three functions were divided in various ways between two individuals. On cash-tenant farms, organization was divided, while management and labor were furnished by the tenant. On share-tenant farms, the owner was largely the organizer; and the tenant, the manager and the laborer. On cropper-tenant farms, labor was the tenant's contribution.

It is highly improbable that there exists on any of the farms as fine a distinction between organization and management and labor as is set forth in this chapter. Even on the relatively few manager-operated farms, the manager usually assumes a number of the organizational responsibilities. Practically the same is true with cash-tenant farms.

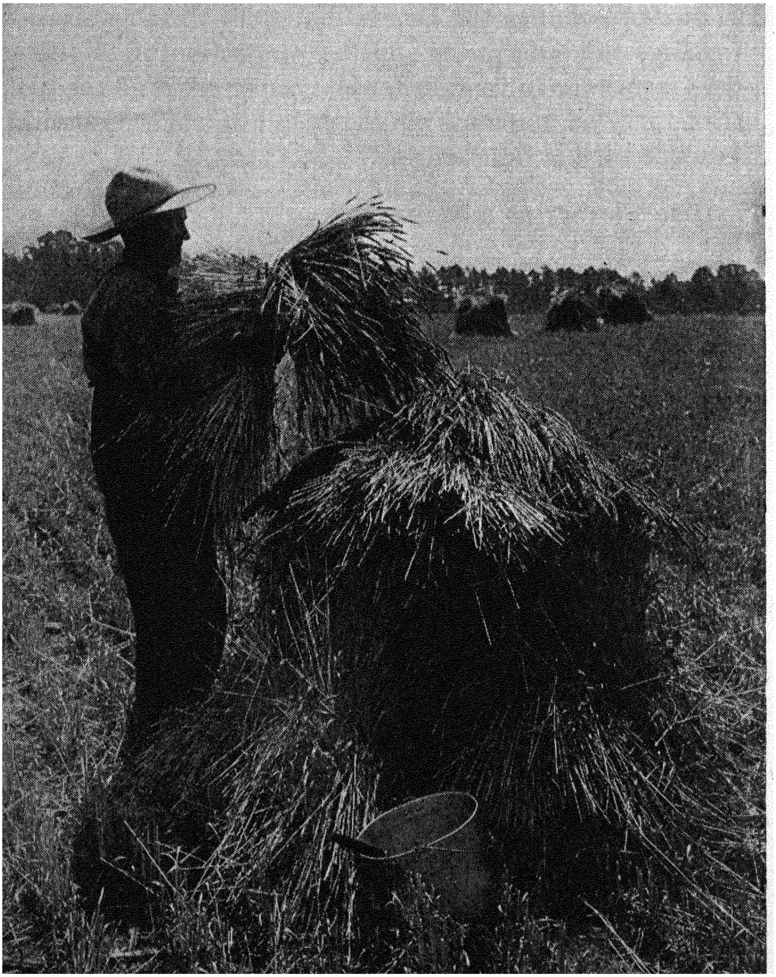


Illustration from Bu. of Agr. Econ.

Fig. 49. The farmer is often both laborer and manager.

Thus the farmer as a manager operates the farm he owns and has organized. He controls labor, which in reality is his own labor, and reports to the organizer, who is himself. Notwithstanding these peculiar facts, the managerial functions and problems exist as distinct and separate from those of organization and labor. Isolating these functions for separate treatment, although seemingly superficial, is necessary and extremely valuable.

3. Management in Farming and in Industrial Enterprises Compared

Perhaps the concept of the farmer as a manager may be made clearer by comparison with management in industrial or urban businesses. Of course there are wide variations in the amount of responsibility relegated to the industrial manager, but the differentiation of functions is sufficiently uniform to allow some generalization. The typical industrial manager will be assigned practically the same duties as were outlined early in this chapter. A larger organization and a finer division of tasks may multiply the manager's specific functions, but, in general, his position is about the same. He is directly governed by an officer of the company or a board of directors to whom he makes reports from time to time. The information he supplies will assist this board of directors in the formulation of policies and in making various changes. The accountant has a distinct function in the industrial business, while in farming this function is performed by the manager. The industrial manager, like the farm manager, must make certain decisions from time to time but must look to a higher authority for major decisions.

The combination of the functions of management, of organization, and of labor in one individual, as in farming, has several important advantages. Both manager and organizer are sure to be in close touch with every detail of the business. If not performing the operation himself, the farmer is close at hand, ready to give minute direction. Another advantage is that the other functions can be combined with labor without interfering with it to any great extent. Various odd duties of management, such as posting accounts or arranging business dealings, can be done when work is slack, or at night, or on rainy days. A third advantage lies in the fact that even important decisions may be made coincident with the origin of the problem; that is, delays in adjustments are almost completely avoided. On the other hand, there is one very important disadvantage. The qualities required for successful performance of the three varied sets of functions will rarely, if ever, be found in one individual. The good workman will, in many cases, be a poor manager, not possessed of the necessary qualities needed to assume responsibilities, and vice versa. Indeed, this is one of the chief causes of failure among farmers.

4. Scientific Management

One of the latest developments in industry is scientific management, which attempts to develop a science for each element of man's work, and to apply this to the individual tasks. Developing this science involves collecting all knowledge on the particular subject, classifying this knowledge, and formulating it into laws, principles, and formulas. To apply these laws, the workers are selected and trained in detail; their work is checked and inspected. Scientific management is alleged to obtain the initiative of the workers with absolute uniformity, to standardize all productive processes, and to increase greatly the efficiency of all operations. The study and the analysis of the tasks involve careful time studies and comprehensive research; the selection of the workers presents a difficult problem; and completely installing the system in a factory takes a number of years. Each task, each worker, and each plant presents new and different problems; hence, there can be no one solution which, when worked out, is applicable to all conditions. Only by having a large volume of output can the cost of scientific management be borne by an industrial plant.

Scientific management has not been applied, until recently, to farming. In the past it has been thought that the farm units were too small, or the various farm tasks did not lend themselves to standardization. The farm laborers, because they had to perform a number of different tasks or because they were hired for short periods, could not, it was said, be trained to do things in the most efficient manner.[2] All of this has been radically changed. Today under the able leadership of E. C. Young,[3] of Purdue University, this point of view has been modified and some excellent work has been done in what is called *work simplification.* It is, however, desirable in considering the application of scientific management to farming to keep in mind its limitations. These have been succinctly set forth by Lester Blum as follows: [4]

> 1. Increases in productivity per worker, attributable to scientific management, are seriously limited unless coupled with an incentive wage system.
> 2. Job analysis in agriculture is restricted by uncertain and discontinuous working conditions.
> 3. Standards of work performance, as used in industry, are not easily applied to farming because of the lack of a uniform working environment.
> 4. The possibility of increasing the productivity of farm workers by work-simplification techniques is greatest in repetitive, time-consuming tasks.
> 5. Variations in methods of work performance are not always evidences of inefficiency. In many cases the particular method used by a worker has been devised to prevent the onset of fatigue or monotony.
> 6. Where work-simplification methods are applied to hired labor, care must be taken not to stifle the worker's ingenuity or interest in the job.
> 7. Where many hired laborers are employed to do farm jobs, the following considerations need to be taken into account:
>   a. The training involved in introducing a new procedure.
>   b. The additional cost of supervision.
>   c. The effect the new method has on labor turnover.

---

[2] See third printing of this text, page 329.

[3] See "Work Simplification News Letter," Purdue University, Agr. Hall Annex.

[4] "Work Simplification News Letter No. 9" Oct., 1944, Purdue University.

- d. The influence of new work routines on management-labor relations. Unionism in agriculture can be easily accelerated by thoughtless speed-up or absence of work incentive.
- e. The adjustment of wage rates corresponding to the increases in productivity effected. At least a 1 per cent increase in wages should accompany each 1 per cent in productivity.

8. Scientific management usually requires more supervision than conventional work procedures—a factor not easily accomplished in agriculture because of the extensive work area involved.

9. The conflicting interests of the self-employed farmer, as worker and entrepreneur, create difficulties in the application of job analysis not encountered in industry.

10. Process analysis offers many possible economies of labor use in agriculture. Before applying any new method, layout, or piece of equipment to a process the farmer should know:

- a. What it will cost in terms of time, money, and physical energy to employ or develop a new procedure.
- b. How much the new method will save in terms of time, money, and physical energy.
- c. How long the installation of the new method will take to pay for itself.

11. The psychological factors influencing fatigue, monotony, farm accidents, and the general health of farmer affect labor efficiency in agriculture seriously enough to warrant further investigation and research.

12. There is already evidence that research workers in the field of farm-labor efficiency are neglecting completely the psychological factors affecting productivity, despite the experiences of industrial efficiency experts.

Questions

1. Compare and contrast farm organization with farm management.

2. What are the important functions of management?

3. Describe briefly the manager's duty or function as the director of the resources of the farm.

4. To what extent is the farm manager at one and the same time the farm organizer and the farm laborer? What are the advantages and disadvantages of such conditions on the farm?

5. State some of the major limitations of the application of scientific management to agriculture.

References

Black, J. D., *Production Economics.* New York: Henry Holt, 1926, Chapter XIX.

Boss, Andrew, *Farm Management*. New York: Lyons & Carnahan, 1923, Chapter XIII.

Holmes, C. L., *Economics of Farm Organization and Management*. Boston: Heath, 1924, Chapter XVIII.

Hopkins, John A., *Elements of Farm Management*. New York: Prentice-Hall, 1936, Chapters XX and XXI.

Johnson, Alvin S., *Johnson's Introduction to Economics*. Boston: Heath, 1922, Chapter VIII.

CHAPTER XIX

The Management of Labor and Working Capital

THE plans of organization include, insofar as possible, the manner in which all of the factors of production are to be used on the various enterprises throughout the year. These plans, however, cannot be detailed enough to take into account all problems which may arise; thus new decisions must be made from time to time during the year. The responsibility for making these decisions, for controlling the factors of production with the object of obtaining maximum efficiency from each, rests with the manager.

This chapter is to be devoted, then, to a discussion of those problems arising with respect to labor and capital, for which the manager must assume responsibility. Because of its peculiar nature, labor presents a more complex set of problems than either capital or land. A machine may be expected to react to handling in about the same way day after day, to run at a given speed, to do a certain amount of work, and to depreciate in a given way. On the other hand, labor may vary from one minute to the next; the amount of work done may be dependent upon the attitude of the laborer as much as upon his capacity; labor appreciates and depreciates in a certain peculiar way; and labor is subject to fatigue. This all leads to the conclusion that a laborer cannot be put out to do a given piece of work with absolute assurance that the work will be done. The result is that labor must be expertly handled at all times in order to obtain continuous efficiency. This is even truer in agriculture than in urban industry because of the lack of standardization of tasks and of the diversity of tasks to be performed.

1. The Selection of Labor

The problems of selection are primarily concerned with hired labor. A large part of the labor hired on farms in the United States is employed for only a part of the year; that is, extra labor is needed only at certain periods of the year. Such is not the case with the other factors, the selection of which is a problem of organization rather than of management. The average working period of labor on the farms using hired labor is less than 160 days. Obviously, the labor is employed after the year begins and released before the year is out. Selection of this labor is, therefore, a management problem. Even when labor is noncasual, or employed the entire year, as in factories and on some farms, selection is often considered a managerial responsibility.

If all of the characteristics of a good laborer were to be tabulated as guides to management in selecting a laborer, the list would be quite large. Various writers have listed health, skill, intelligence, willingness to work, honesty, ability to take and execute orders and to assume responsibility. Such considerations are important, of course, but the treatment here cannot be broad enough for them to be discussed. Then, too, it is impossible for the manager to determine in a short time all such traits in a prospective laborer. Any method of selection which takes personal traits into consideration must rely chiefly on the insight and judgment of the manager.

The other side of the problem, that of the ability of labor, must take into consideration the requirements of the jobs to be done and the stated qualifications of the laborer. The selection must, of necessity, be made quickly and in most cases on the basis of a single interview. The tasks required of labor will in most cases be varied in nature; hence specialized skill is not so important as general ability and adaptability. Thus general intelligence, a characteristic rather easily judged by interview, is an important consideration. In this connection references from former employers of the laborer may prove useful. If the former employer is near at hand, a personal interview concerning the prospective laborer will be advisable. References should furnish some detailed information as to the efficiency of the laborer at certain tasks as well as statements as to his character and general intelligence. Of course, the primary objective is the selection of labor which will perform the tasks most efficiently and can be paid for with the funds available for wages.

2. The Assignment of Tasks and the Training and Supervision of Labor

In different places throughout this book it has been pointed out that farming is characterized by a diversity of tasks. It follows that the hired labor will be best suited to some of these, family labor to others, operator's labor to still others; and, if there are more persons than one involved in any of these groups, some laborers will have qualifications better suited to the performance of some tasks than of others. Efficiency in each operation and in all operations as a whole will be greatly influenced by the way in which these tasks are assigned and will be dependent on proper assignment. Operation of machines, feeding livestock, and numerous other tasks require a certain amount of acquired ability for proper performance. Lack of special ability on the part of the laborers means inefficiency.

Because the laborer is a human being, the efficiency with which operations are performed will be influenced also by the attitude with which the laborer approaches the task. Each worker will conceivably have preferences; and, even if these conflict with ability, it may be advisable to give way to them. A limited amount of experimentation and reassignment together with personal questioning should help considerably in solving this problem. Dissatisfaction usually results in "soldiering" and inefficient performance of operations.

The supervision of labor is one of the most important duties of the manager. This means seeing that each task is performed in the best way available. No laborer, if left alone, can be expected to work with maximum efficiency or to perform tasks to the best of his ability at all times. Even if he could be expected to do this, supervision is important as a method of teaching new techniques and of training inexperienced help.

Courtesy of N. C. Dept. of Agr.

Fig. 50. The direction of labor and machinery is an important function of management.

The training of farm labor is not a difficult task. The important thing is for the manager to know how a given task can be done efficiently and then be able to teach others how it should be done. As a preliminary step in the training of labor to do a specific task effectively, the task itself must be divided into its components or sub-tasks. For example, the picking of tomatoes can be divided into: (1) The type of container or basket to be used in picking; (2) the position of the container with respect to the picker;

(3) the use of hands in picking; (4) the posture of the body of the picker; (5) the shifting of the container from one place to another; and (6) the removal of the container from the field to the assembly point.

After the task has been resolved into its component parts, the manager must then analyze the operations. The purpose of this analysis is to determine: (1) the operations, if any, which can be eliminated without loss in efficiency; (2) the operations, if any, which can be combined effectively; (3) the changes in the order of performance; and (4) the equipment needed and its arrangement.

This analysis will usually reveal the weaknesses in doing any specific task. Once these defects are discovered, the manager must then devise ways and means of doing the task more effectively. This may not be an easy task. The manager may have to proceed on the basis of trial and error. If, as a result of the job analysis, several operations are eliminated or combined, or the order of performance is changed, the manager must then put his new scheme into use and determine the results in time saved or lost, or other advantages or disadvantages of the method of procedure. This application of the new method may suggest to the manager other desirable changes which should be made. Thus by "trial and error" the method of doing a specific task is perfected.

It may not be necessary for the manager to do all of the experimenting. For many farm tasks sufficient information is now available to indicate how they should be done.[1] For example, in tasks requiring repetitive operations, such as the picking of cotton, fruits, or corn, the following rules have emerged as a direct result of experimentation: [2]

---

[1] Specific directions are available for doing many farm tasks. If interested, the reader should write to the Experiment Station in the state in which he is located or to the U. S. Department of Agriculture, Washington 25, D. C.

[2] "Work Simplification News Letter No. 8," July, 1944, Purdue University.

a. Use both hands when possible.
b. Use continuous curved motions of the hands when possible.
c. The eyes should direct body movements. They should lead rather than accompany body movements.
d. Have things within easy reach.
e. The sequence of operations should take the fewest motions.
f. Complete a cycle of operations where practical before laying down tools or carriers. In other words, do not lay things down unnecessarily to be picked up later.
g. Be comfortable.

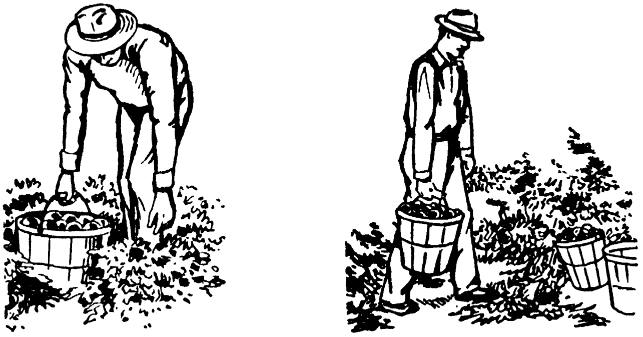
To be more specific, these rules may be applied to the picking of tomatoes. For this crop, four rules have been formulated, as follows:

Rule 1. Use a handle on the hamper. The purpose of this rule is to provide a means of moving the position of the hamper quickly, to avoid bending down to pick up the hamper which would involve the use of both hands, and to reduce the risk of dropping the hamper and injuring the tomatoes. (See A and B.)

Rule 2. Pick with both hands at the same time. The object of this rule is to speed up operations. In putting this rule into effect it is necessary to instruct the picker to pick with his or her hands close together. When hands are far apart the picker has more difficulty in seeing what both hands are doing, and this adds to the fatigue of picking. It is important to avoid squatting or resting the elbow on the knee when picking, since these actions either increase fatigue or reduce the speed of picking. (See C and D.)

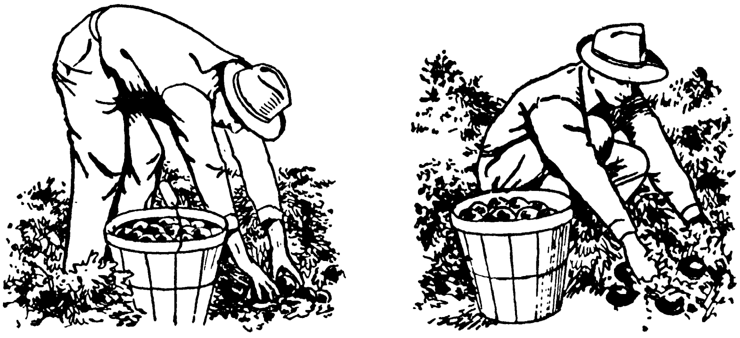
Rule 3. Pick as many tomatoes as possible with each hand before moving hands to the hamper. In executing this operation, "first pick one tomato in each hand, then shift the tomatoes back into the palms of the hand." This procedure permits each hand to pick at least two tomatoes. After the two tomatoes are picked they should be moved in unison to the hamper. (See E and F.)

Rule 4. Pick two rows and keep the hamper in front of you. Labor should be cautioned not to place the hamper



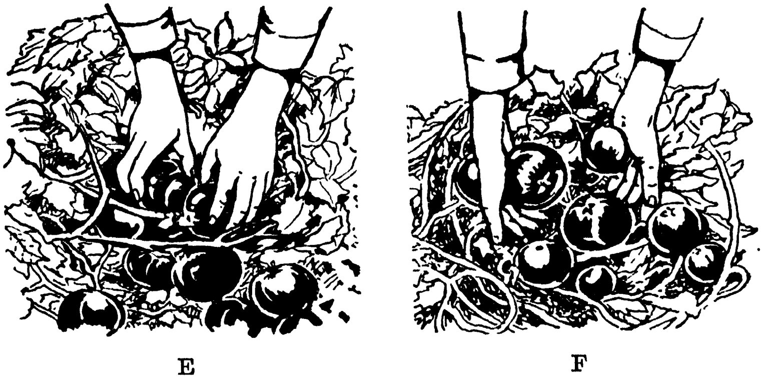
A B

Rule 1. Use a handle on the hamper.



C D

Rule 2. Pick with both hands at the same time.



E F

Rule 3. Pick as many tomatoes as possible with each hand before moving hands to the hamper.

too far away, but place it so it can be reached easily. If the picker gets in front of the hamper, he must turn around, which reduces speed and adds to fatigue. (See G.)

3. Developing Initiative, Good Will, Coöperation, and Respect

It is recognized that labor is more effective when individual initiative is developed and when management maintains the good will, the coöperation, and the respect of the labor force. The best work is not to be had from slave labor, no matter how able the workers nor how close the supervision. Neither is the best work to be had from free labor, since there is no initiative to efficiency. Perhaps the system of wages is the best method of developing initiative, at least in urban industry, where bonuses, piece rate, profit-sharing, and so forth, are common methods of inciting initiative. In farming, such methods are, as a rule, rare, time rates being more common. Labor may be released before profits are known; thus, profit sharing and bonuses are not applicable to farming. Lack of standardization makes piece-rate wages not universally adaptable. Some operations, such as corn husking and cotton picking, are paid for on this basis, but generally speaking the method is not used. These modes of payment, however, should not be overlooked in any attempt to obtain the full coöperation of the laborer.

G

Rule 4. Pick two rows and keep the hamper in front of you. (Illustrations courtesy of Webb Publishing Company and Sinclair Refining Company.)

Development of initiative, then, falls in a class with the others. In order to develop all these feelings it is necessary to establish in the mind of labor a confidence in organization and management and a belief that the interests of labor are not lost sight of in view of the more prominent interests of the business as a whole. This can be done on the farm by exercise of tact and strategy in all dealings with labor. Labor must be made to feel that it is equal in some respects to management; nevertheless, it must recognize the final authority of management in all operations on the farm. The fact that management works alongside of labor—becomes labor, as it were, for the time being—helps to create a feeling of equality, but only confidence created by wise decisions can establish respect and initiative. The good manager will be able to make decisions wisely, yet to handle labor so as to develop good will and coöperation through continuous personal contact. To accomplish these purposes will require the constant thought and attention of the manager.

4. Planning Day-to-Day Utilization of Labor

One of the most important responsibilities of management is that of seeing that all labor, hired, family, or otherwise, is used fully and in the most profitable way, day after day. Such a utilization usually requires planning some time in advance a detailed labor program. With the diversity of tasks on the farm, there will often be periods when there are several apparently important things which might be done. The question arises as to what should be done. If the decision is postponed until the problem arises, valuable time is apt to be lost and the hasty decisions are likely to be faulty. By planning ahead, the question of opportunity costs may be taken into account and the decisions may be made consistent with the planned profit of the farm as a whole.

Such a plan for labor may take any one of several forms. Some advantage will be gained by merely having at hand a list of things to be done when weather or soil conditions prevent field work. In other words, the farmer may have a list of: (a) jobs to be done when it is raining; (b) jobs to be done when the soil is wet but it is not raining; (c) jobs to be done when ground is frozen; and (d) jobs to be done when snow is on the ground. Such jobs include miscellaneous work on buildings, fences, ditches, woodlot, machinery, roads, harness, equipment, and the like. There are usually enough of such days to allow all this work to be done, leaving all the other time for field work.[3]

The labor applied directly to the sources of income, whether crops or livestock, is, of course, the most important labor. A much more detailed plan for field labor will be necessary if the fullest utilization is made of all labor. Such a detailed plan involves: (a) listing the enterprises; (b) listing the work to be done on each enterprise; and (c) arranging these various jobs in the proper way. The finished plan may consist of a detailed list of the work to be done each month or each week, or it may consist of a complete list of jobs to be done with an arbitrary time limit set for each job. If the farmer were able to plan it, the week-by-week analysis would be better, but, in view of the fact that all plans must be tentative to allow for weather, the latter plan is the more usual. The plan may be somewhat as follows for each enterprise:

Enterprise and Operation	*Date*	*Classification*
Cotton:		
Cutting stalks	Jan. 11 to Mar. 15	Semiurgent
Disking	Jan. 1 to Mar. 15	Semiurgent
Breaking land	Jan. 1 to Mar. 15	Semiurgent
Harrowing	Mar. 15 to Apr. 15	Urgent
Running rows	Mar. 15 to Apr. 15	Urgent
Fertilizing	Apr. 10 to Apr. 30	Urgent
Ridging	Apr. 10 to Apr. 30	Urgent
Planting	Apr. 10 to Apr. 30	Urgent
Cultivating	May 10 to May 20	Urgent
Chopping	May 12 to May 25	Urgent
Cultivating (3–6 times)	May 20 to Aug. 15	Urgent

If the farmer is able to estimate in advance for each enterprise the labor that will be needed for each operation, the plan for labor can be much more complete and the value of planning will be greatly increased. He will be able to arrange for extra help ahead of time and to test out in advance his system of enterprises as far as conflicting operations are concerned.

---

[3] Taylor, *Outlines of Agricultural Economics,* p. 78; and Warren, *Farm Management,* p. 337.

Not infrequently it will be necessary to prepare detailed instructions for the operation of an enterprise. This is especially true if the work is to be assigned to one individual of the labor force who will be held responsible for it. Note the following instructions for the care of the laying flock of the poultry enterprise. This enterprise has been profitable ever since it became a part of the farming system, and its success has been due largely to reducing the tasks to a routine as provided for in the instructions and an insistence that each task be performed in accordance with these instructions.

Directions for Care and Management of Laying Flock

A. *Feeding and watering:*
   1. Keep laying mash before birds at all times.
   2. Before putting in fresh feed, mix old and new feed together.
   3. Keep oyster shell before birds at all times.
   4. Feed laying hens "scratch" twice daily, ⅓ in morning and ⅔ at night. Scratch mixture should consist of 60 per cent corn and 40 per cent wheat. Feed scratch at the rate of 10 lbs. for hens, 12 to 14 lbs. for pullets, per 100 birds per day. "Scratch" should be fed indoors in hoppers. Feed same time each day.
   5. Keep fresh water before birds at all times.
   6. Clean watering troughs daily.
   7. Warm the water during the cold days in winter.

B. *Sanitation:*
   1. Clean roosts once a week.
   2. Replace litter, and clean out nests once a month during warm weather and every six weeks in cool weather.
   3. Remove droppings daily from feed and water rack.
   4. Spray roosts with a mixture of kerosene and used cylinder oil (½ kerosene and ½ cylinder oil) when litter is removed during spring, summer, and fall.
   5. Put "Black Leaf 40" on roosts every six weeks during the late spring, summer, and early fall.
   6. Sweep and clean feed rooms daily. Do not leave on the floor any feed or other material.
   7. Remove from flock and record all sick, weak, or dead birds.
   8. Place dead birds in garbage can provided for this purpose.
   9. Report immediately any evidence of an epidemic in flock.

C. *Care of eggs:*
  1. Keep an accurate daily record on form provided of all eggs produced.
  2. Grade eggs into two classes:
     a. Small or pullet eggs.
     b. Standard eggs.
  3. Clean dirty eggs before putting into cartons or egg crates. Eggs should be cleaned with *damp* rag to which has been added a small amount of baking soda, or by gently rubbing with steel wool.

D. *General:*
  1. Save all feed bags. Be careful not to cut tops when opening.
  2. Keep rat poison in feed room at all times.
  3. Make minor repairs immediately.
  4. Wash and clean windows twice a year.
  5. In the fall prepare hen yards and sow Italian rye grass; in the spring sow a mixture of crimson clover and lespedeza.
  6. Keep weeds cut around the poultry plant.
  7. Clean and store any equipment not in use.
  8. Lower curtains at night in cold weather and when raining, snowing, or very windy.
  9. Keep poultry houses locked at all times except when operator is in immediate vicinity.
  10. During warm weather be sure that all windows are open and curtains raised.
  11. Do not allow any visitors to enter poultry houses except with permission of owner, especially feed salesmen, who are frequently carriers of diseases from other poultry plants.

5. Making Day-to-Day Adjustments

Although a detailed labor program may have been devised and put into operation, there remain decisions to be made if labor is to be used most efficiently throughout the year. Conditions which require immediate attention will arise unexpectedly on any farm. The maturity of the main crop may have preceded expectations, and, in order to harvest it, the operator must delay some other work. Heavy rains may have fostered weed and grass growth in the corn, and, in order to cultivate it and save it, oat seeding or some other important operation may have to be postponed. All such conflicts cannot possibly be foreseen, and the decisions and adjustments must be made. With management rests the responsibility for making these, just as does planning the program in the beginning. In each case, the adjustment or decision will be made in view of the relative *effects of the conflicting operations* on the prôfits from the farm as a whole.

6. Providing Social Life

One of the peculiar characteristics of the human agent in production is that it is greatly influenced at every turn by social considerations of every kind. In farming this presents a particular responsibility because farm labor has no organization such as the urban industrial trade unions; farm life is rather isolated for unmarried labor; the city entertainments are lacking; there are no laws governing the handling of farm labor; and being a farm laborer is not what one might call a socially desirable or estimable occupation. It is obvious that under such conditions providing a satisfactory social life presents quite a problem. The incentive to ownership makes some laborers willing to forego city social advantages. Other laborers are transient or casual, and care little for such social considerations. Farm life does possess certain social advantages however, and there are some things the manager can do to provide this life. Quite often the hired laborer is taken into the family and allowed to enjoy its social life. Various writers on the subject have mentioned other means by which this objective is reached, including use of horses and vehicles, holidays, trips to town, books and magazines to read. All of these things should help to make the laborer satisfied to live on the farm and to work with good spirit. They should help to secure continued services from desirable labor. These considerations apply to the manager's labor and family labor as well as to hired labor. Providing this social life is an important managerial responsibility, because in the absence of it, labor turnover is likely to be more rapid and the more or less intangible spirit of the laborers lost.

7. Working Capital Defined

Working capital will be used here to include any goods used in production other than land, labor, buildings, and fences. In other words, all workstock, machinery, equipment, power engines, feed, seed, fertilizer, and other materials are included in this category. The question might well be raised as to the value of this discussion when labor has been discussed already and when all of these elements must be moved, propelled, or handled by labor before entering into the scheme of production. The two factors, labor and working capital, are in many ways inseparable and in all ways closely related; but since they are distinctly different in many ways and require different handling, for analytical purposes it is thought best that they be discussed separately. To illustrate this connection: If it is planned for labor to perform a certain operation on a given day, it is also necessary to plan for certain elements of working capital to be available for use on that day. But such considerations as purchase, storage and availability of materials have little to do with labor. A clearer concept of the man-

Illustration from Bu. of Agr. Econ.

Fig. 51. Rural planning is one way of making farm life attractive.

ager's responsibility for each of these elements will be gained as the discussion proceeds.

8. Planning the Use of Working Capital for the Year

Plans for the use of working capital will avoid conflicts in the use of machinery, equipment, or workstock, will allow a fuller utilization of these same elements, and will provide a scheme for the provision of various supplies and materials necessary in the performance of operations. These plans, particularly for machinery and equipment which are more or less general in nature, will need to be rather flexible to take care of weather and soil conditions. That is, except with workstock and power engines, there is little use to be made of working capital on the farm when field or routine work is slack or when it is delayed by adverse conditions. Therefore, any plan which calls for the use of a cultivator, for example, every day from June 1 to July 31 will, in most cases, be of little use because there will almost always be days when field work cannot be done. The plans for the use of specialized machinery, such as a combine for wheat harvesting, are important in that an arbitrary time limit may be set on repairing, conditioning, and providing materials for operation. Plans for fertilization set time limits on fertilizer purchasing and mixing. In short, detailed plans for all elements are necessary to facilitate a smooth, forward-moving program or to avoid costly delays.

9. Adjustments in Working Capital

Somewhat of a corollary to the planning discussed is the responsibility of seeing that the plans are carried out and also of making any adjustments necessary in view of emergencies. In sharp contrast to the industrial manager, the farm manager cannot expect that a detailed plan made in advance can serve as a production guide for the year. The reasons for this have been stressed enough to be thoroughly familiar to the student. Weather conditions are apt to hasten some operations and to postpone others, causing conflicts in the use of machinery and equipment and changing the time when materials need to be available for use. Changes in prices may make necessary some adjustments in the feeding of livestock; that is, more feed may have to be acquired or rations cut down, or one class of livestock may have to be fed heavily at the expense of another. The adjustments should be made in favor of the enterprise which has the greatest positive effect on total profits, or in favor of the operation which adds most to total returns for the farm as a whole. Thus, when two crops unexpectedly compete for the use of machinery or equipment or when two classes of livestock unexpectedly compete for the feed available, it becomes a managerial responsibility to decide which enterprise shall be favored, and to what extent. A margin of safety in feed planning and in equipment planning will help considerably to avoid such conflicts, but the margin should not be too wide, or fullest utilization will not result.

10. Supervising Working Capital

In general, the objective in supervising the use of working capital is to prevent wastes in the use of seed, fertilizer, feed, and other materials, and to prevent abuse and rough handling of machinery, equipment, and workstock. In the case of materials, any amounts wasted are direct losses and tend to lower efficiency by increasing the input per unit of output, since any amount wasted must be considered as attributable to the productive processes. When the value of feed and fertilizer used each year is high, even a small waste is important. In the case of machines, the prevention of abuse tends to prolong their period of usefulness, thus decreasing the proportion of the cost to be borne by each year's use.

Supervision of working capital is a function or responsibility closely allied to that of labor supervision. In this case, however, supervision is directed at efficiency in use of capital goods, rather than at efficiency in time and labor. Labor may easily be the direct cause of the greater part of these wastes or abuses; thus detailed supervision of labor may serve a dual purpose. In other cases, however, wastes may occur because of oversight on the part of the manager in failing to inspect machines that are using materials, or in failing to correct inefficient practices responsible for wastes. Each class of working capital should be kept under detailed surveillance at all times and in all productive processes, so that maximum efficiency in its use is obtained.

The great majority of feeds grown for livestock must be stored on the farm for future use, for they are harvested during a relatively short period but used the year round. Machinery, equipment, and engines are used only a relatively small percentage of the time and must be stored the other part of the time. Workstock must be given shelter and care at all times. The responsibility for seeing that this storing is done and that it is done in such a way as to prevent excessive deterioration and obsolescence rests with the manager. Efficient storage is another way in which wastes and abuse may be prevented.

With farm machinery, the proper care and repair are the most important requisites for continued efficient use. The manager must see to it that all machinery and equipment are repaired or prepared for operation in time for their use in field operations. This includes sharpening points and blades, oiling mechanical parts, replacing broken parts, painting, and greasing, and a number of other technical considerations. Fuel-burning engines must be checked to see that they are not wasting fuel. Care and repair of all equipment provide ample work for many days during the winter and other slack field-work periods. Provision for such should be included in the calendar of operations.

Workstock require more care when in use than during the slack periods, but it is a continued responsibility to see that they are available for work when needed and that they are given the care and the feed that will result in maximum efficiency in their use. Costly delays in field work are often caused by overwork of workstock or by sickness resulting from improper care and feeding. A veterinarian should be called to inspect workstock before the season of heavy work starts, just as machinery and engines should be gone over for broken parts or parts in need of repair before being used.

11. Purchasing Supplies and Materials

The purchasing of supplies and materials is important in any consideration of the manager's problem. Much of the raw material used in production is provided by the land, but a great part also comes from the capital goods such as feed, seed, and fertilizer. These materials must be bought and applied to the productive processes; then the resulting produce must be sold for more than enough to cover all expenses before profits are realized. Wise purchase of materials is, then, one of the important points where there is an opportunity to increase the margin of profits by decreasing the expenses of production. Since maximum profit is the main incentive of any business, maximum economy in purchasing raw materials is also an objective, for which the manager is responsible.

A writer[4] on purchasing in industrial business has listed the following results of incompetent or promiscuous purchasing: (a) poor prices, (b) inferior quality, (c) purchases made in excess of or short of requirements, (d) articles substituted for those actually bought, (e) excessive investment in materials and supplies, (f) erratic deliveries, (g) unchecked, incomplete, or excessive deliveries, (h) improperly checked and delayed invoices, (i) loss of cash discount, (j) duplicate payment of invoices, and (k) inefficient service, losses, and extravagances.

These are all important and merit consideration, but from one point of view, they represent technicalities: keeping alert, knowing the product, and checking bills. The farm manager's responsibilities as regards purchasing might be expressed in a clearer way by *stating them in the form of decisions to be made.* The farm manager has to decide (a) how much to buy, (b) when to buy, (c) where to buy.

---

[4] Twyford, *Purchasing*, p. 2.

(d) what quality to buy, and (e) how to buy. Offhand these seem rather simple, but in reality each decision involves a number of economic considerations which must be taken into account before any definite decisions are made.

The first decision as to how much to buy will, in the long run, be determined by the specific needs of the farm; but the important question to decide is whether to buy small amounts for short time use, or large amounts to last for a long time. As points in favor of buying large amounts are included the chances for lower prices per unit, the opportunity of realizing profits on rising prices, the advantage of having the materials ready for emergencies, and the opportunity of making hauling a slack-work job for labor. On the other hand, interest must be made on the invested capital; there is chance for losses due to falling prices; and storage losses are apt to occur on the farm. Keen judgment by the manager will be necessary if the most economic course is followed. Speculative buying is not to be advocated, but taking advantage of rising prices may mean considerable saving, and the alert manager should be able to do this without speculating with funds for purchasing materials. Small purchases will be better when prices are falling.

A second consideration involves the time at which the materials should be bought. As mentioned above, materials should always be on hand when needed so that delays in any operation may be avoided. There are seasonal variations, however, in the prices of most farm materials. By buying ahead of time, the alert manager may be able to economize the use of funds. If, for example, fertilizer is cheaper in December than in April, it may pay to buy in December for April needs. There are other factors to consider, however. If credit is extended or funds are borrowed to make the purchase, interest for four months must be added to the December price. The same is true if the farmer buys for cash, assuming that the funds could have been invested elsewhere. Also, any deterioration or carrying charges must be added to the December price before the decision is made. Price fluctuations and labor utilization also enter in, as pointed out in the preceding paragraph.

The consideration of where to buy involves comparative prices, quality, and service obtained from the various sources. Prices, of course, include interest charges as well as quoted prices. Reliability as regarding quality is an important point, since the manager cannot be sufficiently trained scientifically to detect flaws and low grades in all types of materials. Service generally includes delivery, extension of loans, and so on. Maximum economy may involve shifting the source of purchases from time to time, buying coöperatively with a group of farmers, or buying individually. Again, there is opportunity for managerial judgment.

The fourth decision refers to the quality of the materials to be purchased. The question to be decided is whether to pay higher prices for high quality or to pay lower prices for low quality materials. The first consideration is that of marginal costs and returns. The value of the additional produce resulting from use of better materials must be more than equal to the additional cost of the better materials; otherwise, the investment will not be profitable. Estimating the value of the additional produce is often an intricate problem and requires expert managerial judgment. Another consideration is that of the alternative use of the funds. If there is some other part of the business which promises greater returns from the funds than the better materials, obviously it would be more profitable to use the funds for that other part and to be content with low quality or medium quality materials. This consideration is most important only when the amount of funds is limited.

The last consideration is that of how to buy, that is, whether to buy with cash or to exercise the use of credit. Very often this may be answered by the condition of the farm regarding available funds; but, in other cases, the decision will rest with the manager. When credit is used, there is interest to be paid; but, assuming an alternative use for the cash funds if purchases are made with cash, the farmer must also charge off interest if purchases are made with cash funds. There may be a discount for cash which is a point in favor of cash purchase, in which case it may be best to borrow from a bank and pay the merchant or dealer in cash. The admonitions that accompany the use of credit for the purchase of materials are the same as those emphasized in the discussion of credit. (See Chapter XXVI.) In any use of credit, these outlined principles are to be followed, and it is a very important managerial responsibility to see that the good reputation of the farm is maintained with the creditors and that the business status of the farm remains stable and sound. Promiscuous use of credit may easily destroy both of these in a short time.

Questions

1. List the peculiarities which make farm labor a unique farm problem.
2. On what basis should farm labor be selected?
3. How would you develop a spirit of initiative and coöperation among laborers on your farm?
4. What is the value of a labor plan?
5. Discuss, as factors affecting labor efficiency, (a) assignments of tasks, (b) supervision, (c) day-to-day adjustments.
6. Outline how specific tasks may be analyzed.
7. How may laborers be trained to do a given task more effectively?
8. How may the farm manager attain maximum efficiency in the use of working capital?
9. List the decisions to be made in the purchase of supplies and materials.
10. What factors need to be considered in deciding whether to buy fertilizer in April or in December?

References

App, Frank, and Waller, Allen G., *Farm Economics.* Philadelphia: Lippincott, 1938, Chapters XVIII and XIX.

Holmes, C. L., *Economics of Farm Organization and Management.* Boston: Heath, 1928, Chapters VII, IX, and X.

Taylor, H. C., *Outlines of Agricultural Economics.* New York: Macmillan, 1931, Chapter II.

Twyford, H. B., *Purchasing*. New York: Van Nostrand, 1924, Chapter I.
Warren, G. F., *Farm Management*. New York: Macmillan, 1916, Chapters XI and XII.

CHAPTER XX

New Forms of Management in Agriculture

AT various times in preceding discussions mention has been made of the specific functions of the farm manager. These functions have been stressed to such an extent by the economist, businessman, and trained technician that the inference is that the service rendered by such managers is expensive. In the successive train of thought, these questions arise: Can the ordinary farm operator or owner acquire or command the training and ability possessed by the expert manager? Assuming this to be impossible for a large majority of farmers, how can they obtain, if at all, the service of such managers? Will not the cost be so heavy as to be impractical to the average farmer?

Among urban industries these questions normally do not arise because the size of the output is usually so great that the cost of management is relatively negligible. In agriculture the one-man unit predominates, despite a tendency toward a form of partnership as reflected in tenancy. Such partnerships, however, have had little influence in increasing the size of the farm or the volume of output. Obviously, some means other than increasing the output of the individual farm must be provided if the services of a trained manager are to be obtained at a reasonable cost. The following discussion will be devoted to recent developments in the field of managerial acquisition.

1. Corporation Farming

Corporation farming is one of the most interesting of the more recent developments in American agriculture designed to obtain, among other things, the services of expert management. A corporation farm may be defined as a farm, usually but not necessarily large, which is owned and financed by an organization of incorporated stockholders.

Several factors may be held more or less jointly responsible for the beginning of corporation farming and for the carrying forward of the corporate farm to its present status. Perhaps the most important of these has been the increasing financial requirements of practically all types of farming. Land values have, until recently, tended to increase; new and more expensive machinery has been made; and production has become more commercialized. There has been a tendency for the "economic unit" [1] of operation to increase in size. Each new development in machinery has tended to increase the size of this unit by increasing the acreage that each farmer can handle.

Studies made as late as 1931 indicate that in the Corn Belt the "capital investment" [2] ranges from as high as $125 to $175 per acre.[3] It is not uncommon for wheat farms to have an investment of from $100 to $125 per acre,[4] cotton farms from $125 to $175,[5] general farms from $100 to $200,[6] cattle ranches about $25,[7] and commercial fruit farms from $1,500 to $2,000 per acre.[8] The average farmer in Montana is able to handle about 340 acres of wheat together with 600 acres of cattle range land,[9] with an average investment of about $50,000 (based on the above figures). It is readily conceivable that one man with the most modern equipment might be able to handle much more than this, say, for example, a 6,000-acre farm with 1,500 acres in wheat and 4,500 acres in range land. The investment would then be about $250,000. Financing such undertakings and assuming the risks or burden of making a current return on the investment is too much for the individual owner or for the owner-tenant partnership. Distribution of these risks over an incorporation of stockholders provides an alternative.

---

[1] "Economic unit" might have a rather indefinite meaning. For present purposes it may be defined as that unit which utilizes to the fullest the available resources of the farmer, including his managerial ability.

[2] Includes land, buildings, livestock, and machinery.

[3] *Illinois Bulletin 374.*

[4] *Oklahoma Bulletin 199.*

[5] *Texas Bulletin 395.*

[6] U. S. Department of Agriculture, *Bulletin 1388,* and *Michigan Special Bulletin 187.*

[7] U. S. Department of Agriculture, *Technical Bulletin 45.*

[8] *Washington Bulletin 239* and U. S. Department of Agriculture, *Department Bulletin 1435.*

[9] *U. S. Census,* 1930.

Several other factors undoubtedly have been at work in the formation of corporation farms. The almost immediate success of the corporate form of organization in industry undoubtedly has led to speculation regarding its success in agriculture, and to experimentation. Some few philanthropists have been led to invest in this sort of venture by the dream of a large level tract of land smoothly operated under a system similar to that of the modern factory, by indulgence in a cherished hobby, or by persuasion of over-enthusiastic "would-be" expert farm managers. Still another factor has been the participation in certain types of agricultural production by companies already incorporated. Such companies usually deal in the products of agriculture and participate in production to insure for themselves a given supply of produce. Examples of this may be found in wholesale produce companies, canning factories, and the like.

However, from the statistics available, corporation farming is still relatively unimportant. According to the Income Tax Unit of the Bureau of Internal Revenue[10] there were 9,211 corporations engaged in farming in 1929. This number represents only 0.146 per cent of all farms in 1930. There were 7,800 corporation farms in 1920, and 9,303 in 1926. In 1927, however, there were only 8,671, and in 1928, 9,183. In no year since 1919 have as many as half the corporation farms reported a net income. In 1929, of the 8,283 active corporations, 3,886 reported incomes, and the other 4,397 reported losses or deficits. The successful farms reported net earnings of about 58 million dollars, while the others showed a loss of over 41 million dollars in 1929. Thus, the average net income was about $2,000 per farm. The average investment per farm for those turning in balance sheets was about $165,500. The net return to investment was only 1.23 per cent.

---

[10] *Statistics of Income, 1929,* U. S. Treasury Department.

The corporation farm has its advantages and disadvantages. The disadvantages are brought out in criticisms which have been leveled against it as an institution. These may be summarized as: (a) the social life of the rural family tends to be destroyed; (b) there is not year-round demand for farm labor; (c) family labor, more especially that of the children, cannot be used effectively; (d) there is a tendency to urbanize the entire country with the resulting decrease in birth rate and tendency toward racial suicide; (e) the ideal is applicable to only highly specialized production such as wheat growing; (f) the basic differences between agriculture and industry provide limitations to the strict application of factory methods.[11]

A number of these criticisms assume conditions wherein corporation farming replaces the family farm; and, at best, they are based on presumptuous reasoning. The others, particularly the last two, are fairly justifiable.

The important advantages are: (a) the specific functions of management may be recognized; (b) the cost of management may be distributed over a large volume of production; (c) the risks may be distributed over a number of persons; (d) with adequate financial backing the most efficient, however expensive, methods may be used if desirable; (e) economies will normally result from the purchase of supplies and the selling of produce in large quantities.

The developments to date show no evidence of any danger of corporation farms replacing the family farm to any significant extent. The success of the ventures thus far proves that the institution is not the gateway to successful agricultural production. The future is entirely a matter of conjecture. From the author's point of view the ideal presents one possible way whereby farmers may pool their assets, divide risks, obtain adequate financial support, and obtain expert managerial service. In the corporation farm, however, the individual farmer is lost to sight unless he becomes a stockholder as well as a laborer in the "factory."

---

[11] See Chapter I.

2. Chain Farming

Chain farming will be used to designate a system under which a number of farms, not necessarily contiguous, are all owned and financed by one individual or corporation but are managed according to the dictates of a salaried employee as manager. This type of farm management is not new in American agriculture. Plantation owners in the South followed this plan when their farms were broken up after the Civil War. In quite a few instances large estates composed of numerous small units have developed throughout the country to be financed, at least in part, and generally supervised by the owner and a "general manager" or "foreman." A new interest has been developed in this form of operation, however, in the last few years. During World War I and immediate postwar periods, there was a heavy increase in farm mortgages. With the collapse in farm prices, many of these had to be foreclosed; and the banks, insurance companies, and individuals holding these mortgages had a large number of farms on their hands. When these farms could not be disposed of profitably, and such was frequently the case, they were retained to be operated until they could be sold. Except in rare instances, these farms have not been contiguous; thus, the operation of all of them or a number of them as a unit does not assume the characteristics of large-scale farming, but rather, the large-scale operation of a number of average-size farms. The original owner in many cases becomes a tenant under the supervision of a manager who has general control over leasing, financing, organizing, and operating.

The disadvantages of chain farming from the operator's point of view are that he has no share in the risk assumption and profit sharing and that his identity is lost except as a more or less permanent tenant. From the manager's point of view the first disadvantage lies in the fact that the individual farms are usually rather widely separated, and the manager is unable to exercise as close supervision as might be desired. The second disadvantage arises through his partial control. As the tenant usually retains control of working capital, the owner is often reluctant to invest funds in order to give the manager complete control.

The advantages of chain farming are expert management, adequate financial support for production and marketing, retention of the rural family, and economies in selling large volumes.

Unfortunately, there are not definite statistics on the extent, the success, or the failure of chain farms. The most enthusiastic interest in the plan has been in the North Central States, where banks and insurance companies have sponsored such operation of farms acquired by them. In the South also there is still a considerable amount of farming of this type, although frequently without the paid manager. Plans of operation have been presented to some of the large insurance companies whose holdings are very extensive, but these plans have been only partially accepted. The potential use of chain farming has increased with increased foreclosures and more urgent need for constant adjustments in production by a skilled manager. These reasons make the plan particularly interesting as a possibility.

3. Group Farming

Group farming may be said to exist where a number of separately owned and financed farms are operated according to plans suggested by a manager jointly employed and paid by the several individual owners involved. In the strictest sense of the word, the developments in group farming are of comparatively recent origin and as yet very insignificant in extent. Unfortunately, very little information is available either on the extent or the success of group farming. Reference has been made in various publications to the existence of such farming, but there are no specific data.[12] It seems that in the Corn Belt of the North Central States, group farming has become more extensive than anywhere else. The increase in absentee, non-farmer ownership seems to have been an important factor in the development of group farming. Such owners know very little of farming themselves and frequently require at least advisory services in the operation of their farms. One farm manager in Illinois is reputed to number among his clients a bank, an insurance agent, a retired businessman, a merchant, a coal dealer, a theatre owner, and an owner of an estate, all owning one or more farms.

An interesting example of something at least bordering on group farming is provided in the Farm Bureau-Farm Management Service under the leadership of officials at the Agricultural Experiment Station, University of Illinois, with the coöperation of county farm bureaus. The service consists of assistance in keeping detailed accounts, analysis of accounts, and dissemination of the analysis to the owners in a way that will help them in planning for the future. Of the total cost of the service (about $35 per farm), 57 per cent is paid by the owners, 15 per cent by the farm bureau, and 28 per cent by the Department of Farm Organization and Management at the University.

It is hardly possible to estimate the success of this service. The farms selected have, on the whole, made higher returns than has the average farm in that particular area, but the coöperating farms are admittedly above the average. Table 82 shows the rate earned on investment of the farms coöperating in this plan of management as compared with all the farms of the area. If it is assumed that all farms were equal in 1925, it is found that the coöperating farms earned 1.4 per cent more on their investment than those farms not adopting this scheme of management. The margin was increased to 2.1 per cent in 1928, but in the four following years the difference was materially reduced. It is entirely a matter of conjecture as to whether or not these coöperating farms would have increased their returns more or less without the service.

---

[12] See, however, reference to this in *Journal of Farm Economics*, Vol. XV, No. 1, page 75.

H. C. M. Case, of the University of Illinois and leader of the Farm Bureau-Farm Management Service, makes the following statement in regard to group farming in the Corn Belt: [13]

> Enough men are entering the service to establish it on a permanent basis. The unit of land which seems adapted for the work of a man of the right type with perhaps an office helper is about 10,000 acres made up of farms averaging from two to three hundred acres in size. Management service for the family-sized farm, that is, the farm providing full employment of about two men under corn-belt conditions, appears to be gaining in a constructive way, both in the management of tenant farms, and in the coöperative management service to independent coöperators who may be either owners or tenants.

On the whole, group farming receives more wholehearted support from both economists and rural sociologists as a means whereby the average farm or farmer may be placed under efficient management than either chain or corporation farming. In the case of group farming the owner remains an owner, retaining all the characteristics common to the rural family-farm life. From the manager's point of view, group farming carries about the same advantages and disadvantages as were outlined under the discussion of chain farming. Limited control together with the fact that the farms may be widely scattered may restrict the extent to which the manager may actually exert any influence on individual farm problems of organization and management.

---

[13] *Journal of Farm Economics,* July, 1930, Vol. XII, No. 3, pp. 405–423.

TABLE 82

COMPARISON OF FARM BUREAU-FARM MANAGEMENT SERVICE COÖPERATORS IN THE GRAIN-FARMING AREA IN ILLINOIS WITH THE AVERAGE OF ALL FARMS IN THE AREA, 1925–1933 [a]

Year	*Number of Farms*	*Rate Earned on Investment, Coöperating Farms*	*Rate Earned on Investment, All Farms*	*Difference in Favor of Coöperating Farms*
1925	225	3.2	1.8	1.4
1926	210	2.8	1.5	1.3
1927	200	3.7	2.0	1.7
1928	150	5.7	3.6	2.1
1929	380	5.6	3.7	1.9
1930	380	1.0	-0.8	1.8
1931	352	-0.9	1.0	-0.1
1932	190	-1.2	2.4	-1.2
1933	172	3.3	2.0	1.3

[a] *Annual Reports*, Illinois Agricultural Experiment Station, 1931 and 1933.

4. Professional Farm Management Service

The farmer is not limited, however, to corporation, chain, or group farming in his search for assistance in the management of his farm. He may in some states obtain the services of a professional farm manager. It appears that this type of service originated in Missouri in 1916 when Mr. D. Howard Doane became associated with a St. Louis bank and organized a rural service department for the purpose of assisting bank clients to manage their farms. Three years later Mr. Doane founded the Doane Consulting Service, which has played a major part in stimulating this type of work throughout the United States.

The advantages of professional service of this type, as contrasted with the service of a resident manager, are enumerated by Mr. Doane as follows: [14]

1. Coöperation of several experienced minds on creating a definite plan with just enough flexibility to provide for changing conditions.

---

[14] Doane, D. Howard, "Recent Developments in Professional Farm Management in the United States," *Journal of Farm Economics,* Vol. XV, No. 1, January, 1933, pp. 76–77.

2. Continuity of plan and service in spite of changing individuals.
3. Better perspective of manager who, although in close touch with the farm, is far enough away not to let his major decisions be based on the local outlook.
4. Greater marketing efficiency which comes from a closer personal touch with at least one market and adequate contact with other markets.
5. Greater buying efficiency through large combined orders and wholesale connections.
6. Better efficiency in meeting supervision and labor emergencies through shifting men from one farm to another.
7. Greater ability of the organization to attract and to hold men of ability through opportunities for advancement not possible in individual management.
8. Major decisions are usually met by the combined judgment of several experienced men, each with a different point of view, this without dividing responsibility.
9. Greater facilities for making monthly reports and for handling correspondence since the stenographic and other office help involved can be carried by spreading the cost over a number of farms, thus reducing the overhead.
10. The handling of farm accounting at less cost and increased efficiency since one accountant can keep the books on several farms, again spreading the overhead.

The charges for services of this kind are apparently nominal. The usual plan is to charge a stipulated rate per acre for the management of a farm, the rate depending on the type of farming and the amount of consulting work contracted for. According to Mr. Doane, $1 per acre is the common rate, although rates as low as 50 cents may occasionally be charged. Another plan is to make a flat charge plus a certain stipulated percentage of the net returns. A factor affecting the rates charged is the type of farming followed. In the case of crop farming the rate is usually lower than in livestock farming where the organization is more complicated and the management probably somewhat more difficult.

5. General Appraisal of the New Forms of Farm Management

Although various forms of management considered in this chapter possess attractive possibilities which may be used under certain conditions, they do not constitute a solution, either individually or collectively, of the farmer's farm management problem. On the whole, they are limited in their application. They are, as is shown by the available data, applicable only to certain well-defined conditions. Corporation farming certainly is not generally applicable to a wide area or to all types of farming. It is much better adapted to conditions which permit specialization in production and the employment of large amounts of capital than to small farm units characterized by diversification. Chain farming appears to have arisen out of peculiar conditions which developed during the postwar period in which a large number of small owner-operators found themselves in financial difficulties because of unwise credit arrangements made during World War I. It is hardly conceivable that this form of management would have developed among owner-operators free from serious financial embarrassment and not confronted with the condition of rapidly declining net incomes. The success of group farming appears to depend primarily on the development of leadership outside of the farmers themselves, at least in the experimental stages of this form of management. This is evidently true in the case of experiments which have been in progress in the Middle West where the Extension Service and the Farm Bureau have combined to assist farmers in the management of their farms. Nor is it probable that professional farm managers will, at least in the near future, be available to farmers generally. It appears then that in most cases the individual farmer must depend on his own managerial ability for success and cannot depend, certainly to any large extent, on either corporation, chain, or group farming or professional farm management service to supplement his own management. This being true, it is important for each farmer to give particular attention to the methods which have been developed to assist him in organizing his farm on a profitable basis and to use those methods and practices which are apt to give better than average economic returns.

Questions

1. Define corporation farming, group farming, and chain farming.
2. List the factors responsible for the growth of corporation farming.
3. Discuss the relative success of corporation farms.
4. What are the important criticisms of corporation farming?
5. Discuss the relationship between chain farming and the recent collapse of farm prices and mortgage foreclosures.
6. Why is group farming preferred to chain or corporation farming?
7. What is the nature of professional farm management service?

References

Black, J. D., *Agricultural Reform in the United States.* New York: McGraw-Hill, 1929, Chapter XVI.

Boyle, James E., "Corporation Farming in Canada," *Barron's*, September 26, 1932.

Cutting, Malcolm C., "Big Doings in Montana," *The Country Gentleman*, May, 1929.

Holmes, C. L., "Prospective Displacement of the Independent Family Farm by Large Farms or Estate Management, and the Socio-Economic Consequences," *Journal of Farm Economics*, Vol. XI, No. 2, April, 1929.

Iowa Experiment Station Bulletin 307, "Corporate-Owned Land in Iowa, 1933," by William G. Murray and Ronald C. Bentley.

Iowa Experiment Station Bulletin 362, "Corporate-Owned Land in Iowa, 1937," by William G. Murray and H. W. Bitting.

New York Trust Company, "Farming by Corporations," *The Index*, New York, February, 1929.

Ohio State University, *Large Land Holdings and Their Operation in Twelve Ohio Counties,* Dissertation, by Paul George Minneman, 1929.

Steen, Herman, "Corporations Farm Many American Acres," *The New York Times*, May 26, 1929.

The Fifteenth Census of the United States, "Large Scale Farming in the United States," U. S. Department of Commerce and U. S. Department of Agriculture.

The United States Chamber of Commerce, *Large Scale Farming*, Agricultural Service Department, July 29, 1929.

Young, E. C., "Economic Aspects of the Administration of Groups Under Northern Conditions," *Journal of Farm Economics*, Vol. XI. No. 2, April, 1929.

CHAPTER XXI

Economic Reports as Aids to Management

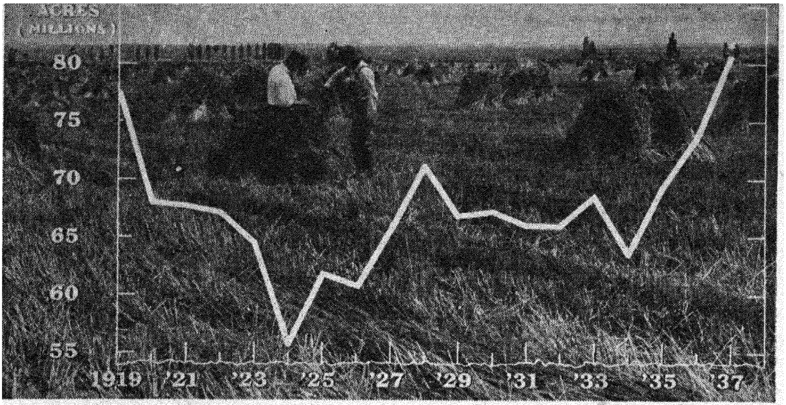
WHEN farming was largely a self-sufficing industry and farmers produced for a restricted and well-known market, there were no complex production and marketing problems. Today, farmers are producing large quantities of products for large domestic and foreign markets. The conditions in these markets from time to time are not well known or understood by farmers. As far as a farmer is concerned, the price which will prevail in these markets at the time his products are ready for sale is one of pure conjecture. Hence, he often and invariably does produce either too little or too much. The farmer's reaction to prices appears somewhat irrational. The tendency is for him to plan his production program not on the probable price in these markets when his products are ready for sale as based on careful analysis of the available facts but rather on prices which prevail when he is ready to plant his crops or breed his livestock. The result is that when the price of a specific product is high (above normal) farmers tend to expand their production, and when the price is low they tend to curtail their production. The reason for this is simple enough. When current production of a specific commodity is large because of the stimulus of previously high prices, the current price tends to be such as to yield a smaller than normal net return. On the other hand, when the quantity produced is small because of the previously low prices, current prices are such that the net returns are much higher than normal. The average net income of any two such years, however, tends to be less than the net income which would be obtained if normal quantities were produced year after year.

1. The Nature of Available Reports

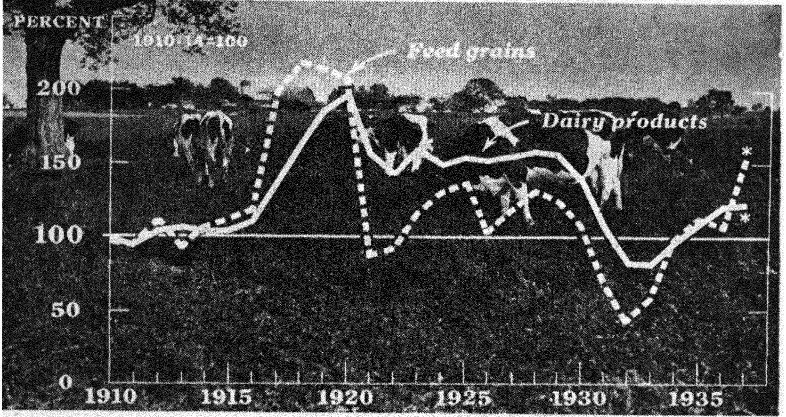
To help rationalize the farmer's thinking and acting, several economic services have been developed by state and federal governments. The two most important are the intentions-to-produce and the outlook reports. The intentions-to-produce reports were first inaugurated by the United States Department of Agriculture in the spring of 1922 when a pig survey was made. Since then intentions-to-plant reports have been issued in the spring of each year about the latter part of March. These reports give the acreage which the farmers intend to plant. Each August similar reports are issued for fall-seeded wheat and rye. Through a coöperative agreement with the Post Office Department, whereby the rural mail carriers are utilized, the Department of Agriculture makes a semiannual pig survey for the purpose of determining the intentions of farmers to breed hogs. Other surveys of this same character furnish facts about dairy and beef cattle and sheep and lambs, indicating feeding conditions, number coming into feeder lot, and other information touching upon the probable intentions of farmers with respect to animal production.

The annual outlook report is issued somewhat earlier than the intentions-to-produce report. Normally, the outlook report is issued the first of February. Recently, sectional reports, such as the outlook for Southern agriculture, have been issued as early as January 1. The outlook report was developed by Henry C. Taylor and H. C. Wallace. At the outset a prominent group of economists and statisticians were called to Washington for the purpose of determining what might be done to assist farmers in planning their production. The purpose of this meeting was to make a forecast of important agricultural crops and livestock products, based upon the best available material. Since this initial conference, reports have been published annually. In these reports the most probable outlook or market conditions for each of the major crops and classes of livestock and livestock

ALL WHEAT: ACREAGE SEEDED, 1919–37



FARM PRICES OF DAIRY PRODUCTS AND FEED GRAINS



HENS AND PULLETS OF LAYING AGE: NUMBER PER FARM FLOCK ABOVE OR BELOW 10-YEAR AVERAGE, LAST DAY OF MONTH, 1925–37

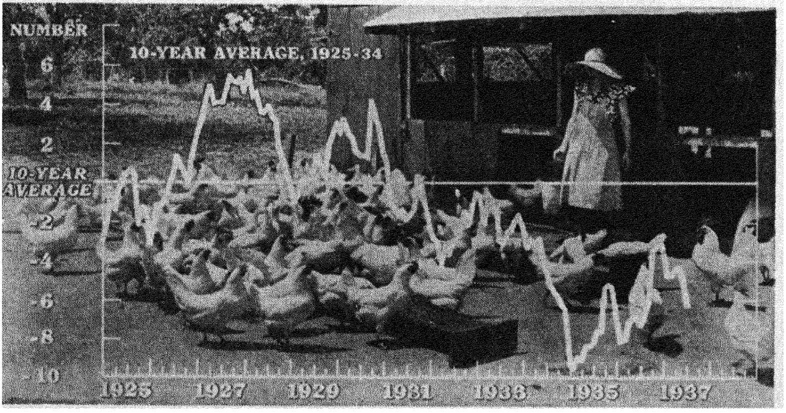
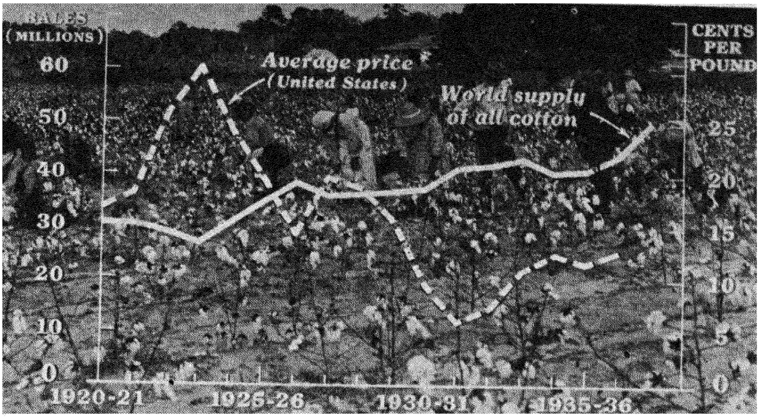
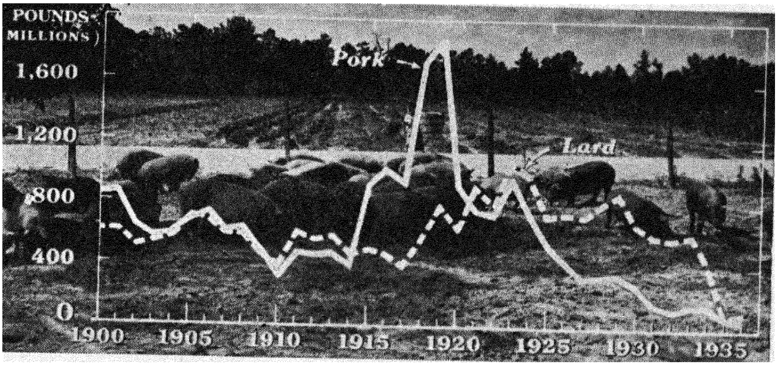


Fig. 52. In order to organize and manage the farm successfully,

COTTON: WORLD SUPPLY AND U. S. PRICES



PORK AND LARD EXPORTS FROM THE UNITED STATES, 1900 TO DATE



CASH INCOME FROM FARM MARKETINGS, NATIONAL INCOME, AND INCOME OF INDUSTRIAL WORKERS

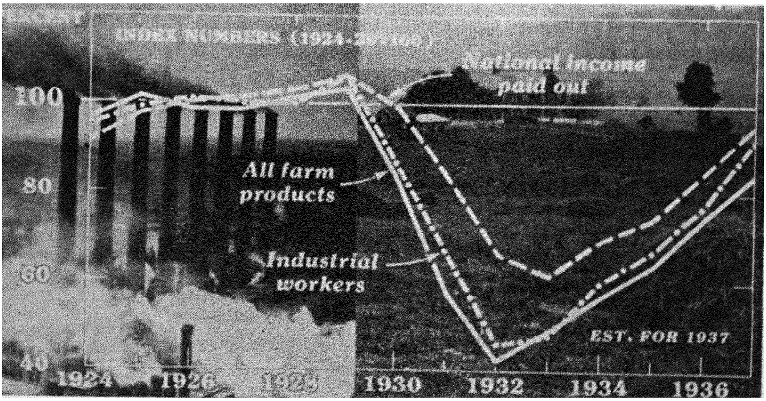


Illustration from Bu. of Agr. Econ.

the modern farmer requires accurate information on many subjects.

products are reported. In addition to the crop and livestock reports, brief statements are made covering the agricultural situation in general, domestic and foreign demand for farm products, agricultural credit and farm labor, equip-

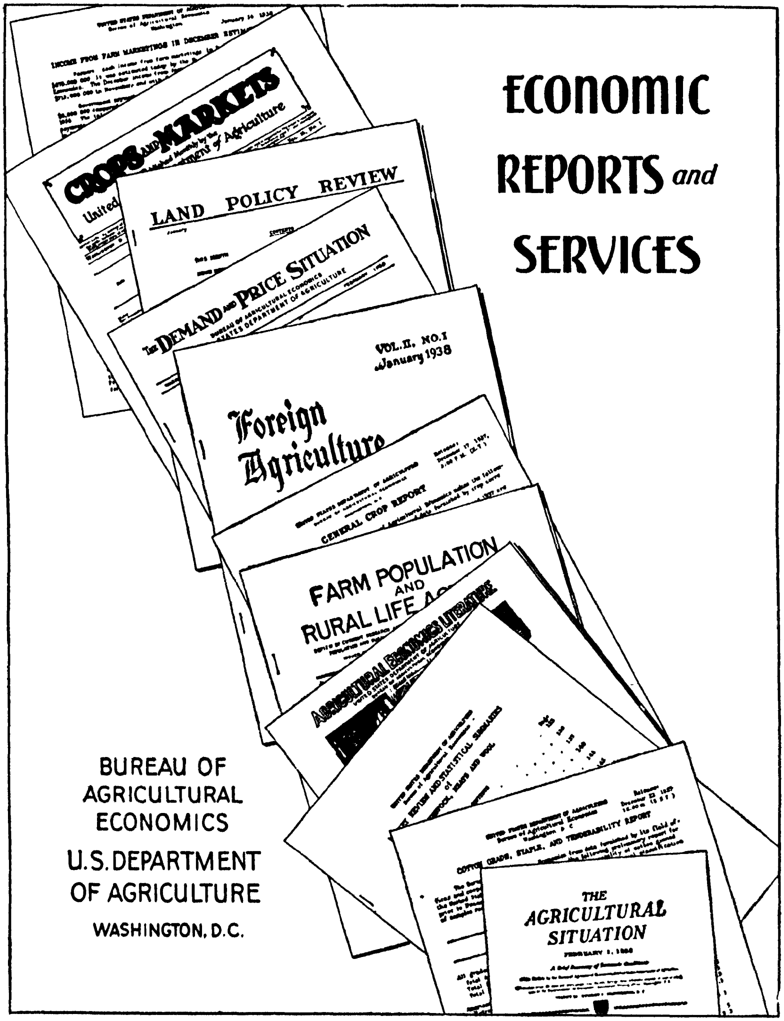


Illustration from Bu. of Agr. Econ.

Fig. 53. The United States Department of Agriculture publishes many economic reports which are available to the farmer.

ment and fertilizer. The annual outlook normally contains over forty statements.

The reports discussed above are perhaps the most important, but others are available to farmers. The Bureau of Agricultural Economics issues from time to time supplementary reports on all classes of livestock. These are issued usually in the summer and fall. Fall outlook reports are issued for fall-planted grains and for truck crops at different times throughout the year. A monthly statement is issued on the price situation. This report covers all important foreign products and is issued shortly after the fifteenth of the month. Other reports such as those on the foreign crops and markets, while not available to farmers directly, contain valuable information on foreign conditions. The information from these reports is usually made available to farmers by the Agricultural Extension Service of the several states.

2. Intentions-to-Plant Reports[1]

The precise nature of the intentions-to-plant reports may be made clear by a few citations:

Corn: The prospective acreage of corn to be planted in 1938 is 94,595,000 acres, which is 2 per cent below last year's planted acreage and 8 per cent below the 1927–36 average. Decreases from last year's plantings are general throughout the Corn Belt States except in Michigan, which shows no change, and in Missouri, where a one per cent increase is expected. Increased plantings are indicated in most of the Southern States.

Tobacco: Reports from growers as of March 1, indicate a prospective tobacco acreage of 1,784,500 acres this year, compared with 1,706,400 acres (unrevised) harvested last year, or an increase of 4.6 per cent. Increases are indicated for all classes, except fire-cured which shows a prospective decrease of 4 per cent, and cigar filler which shows no change. The indicated increases for the other classes are as follows: Flue-cured, 5 per cent; light air-cured, 6 per cent with both Burley and Maryland types constituting this class showing the same increase; dark air-cured, 2 per cent; cigar binder, 14 per cent; and cigar wrapper, 5 per cent.

Potatoes: Prospective plantings of potatoes in 1938 are indicated to be 3,101,700 acres. This is a decrease of about 4 per cent below the 1937 planted acreage of 3,216,200 acres. Assuming an abandonment of planted acreage amounting to 1.3 per cent, about 3,061,000 acres would remain for harvest.

---

[1] Data from the 1938 intentions-to-plant and from outline reports have been used, since they are representative of pre-war conditions.

Peanuts: Reports from growers indicate a prospective acreage of peanuts grown alone for all purposes of 2,050,000 acres. The intended acreage is 5 per cent higher than the acreage grown last year, 2 per cent below the record acreage of 1936, and compares with a 10-year (1927–36) average of 1,780,00 acres.

3. The Pig Crop Report

From the *Pig Crop Report of 1937* we have the following statement:

> The number of pigs saved in the fall season of 1937 (June 1 to December 1) for the United States is estimated at 23,573,000 head. This is 1 per cent or 257,000 head smaller than the number saved in the fall of 1936, and about 17 per cent smaller than the 5-year (1929–33) average. The number saved, however, is larger than either 1934 or 1935. The fall pig crop this year was smaller than that of 1936 in all regions except the West North Central where it was about 3½ per cent larger, and in the Western region where there was no change. The percentage decreases in other regions were: North Atlantic, 6 per cent; East North Central, 5 per cent; South Atlantic, 3 per cent; and South Central, about 1 per cent.
>
> The number of sows farrowed in the fall season of 1937 is estimated at 3,778,000 head, a decrease of about 3 per cent from the number farrowed in the fall of 1936. This decrease is in close agreement with the decrease indicated in the June Pig Crop Report which was based upon breeding intentions as reported at that time. The number of pigs saved per litter in the fall season averaged 6.24 compared with 6.14 in the fall of 1936 and was the largest fall average reported in the 14 years of record. The number saved per litter in the spring season of 1937 was also the largest spring average ever reported, and the combined average of spring and fall in 1937 was 3 per cent larger than in any other year.
>
> The combined spring and fall pig crop of 1937 for the United States is estimated at 62,227,000 head. This number is 3,112,000 head, or 5 per cent, smaller than the combined crop of 1936, and 17,800,000 head or 22 per cent less than the average for the 5 years 1929–33, but is 7,141,000 head larger than that of 1935. Practically all of the decrease in the year's crop in 1937 from that of the previous year was in the West North Central States.

4. Outlook Reports

The following excerpts are taken from the 1938 outlook report and indicate the nature of the information normally found therein:

The General Outlook.

Livestock producers face a somewhat more favorable prospect in 1938 than do the growers of the principal cash crops. The feed supply is much more ample than a year ago, and prices of meat animals and dairy products are likely to be fairly well sustained.

Some of the money crops, especially cotton, have been so large this past season that burdensome supplies will overshadow the coming year's market.

In the case of cotton, wheat, rice, and various fruit and truck crops, growers face the alternative that acreage must be held down in line with normal consumption requirements, or they may have to sell large crops at very low prices.

The major production problem for the farm business in the coming year is to build up the livestock and crop lines which were cut by the droughts, and at the same time avoid a further burdensome surplus of those cash crops which are now in large supply.

Domestic Demand for Farm Products.

Every product that is sold from the farm must find a buyer. The probable demand is one of those things that a farmer, like other businessmen, must figure on when making plans for his year's operations.

Conditions now suggest that the domestic demand for farm products in 1938 probably will not be quite so favorable as during the year past, although conditions during the second half of the year probably will be better than during the first half.

The national income next year is expected to be below the high level of 1937—the latter estimated at about 69 billion dollars. Some increase in wages may offset in part the lowering of industrial production and wholesale prices that may occur.

Foreign Demand for Farm Products.

The foreign demand for American farm products is expected to show little, if any, improvement in 1938. The military operations in the Orient are resulting in a marked reduction in our trade with that area. The volume of our farm products available for export, however, during the remainder of this year and the first half of 1938 is expected to be materially larger than a year ago.

General Price Level.

The level of wholesale prices in the United States is expected to average lower in 1938 than in 1937. Prospective lower prices for raw materials, farm products, and some kinds of manufactured goods, may more than offset higher prices for some lines of finished and semi-finished products.

Farm Credit.

The volume of short-term credit used by farmers and stockmen in 1938 is expected to be at least 10 per cent larger than in 1937 because of rising costs and the need for replacements and more equipment. The supply of short-term credit apparently will be ample.

Interest rates are likely to be little different from those prevailing this year. The demand for new mortgage credit is expected to be small —chiefly for the purchase of farms.

Farm Labor.

Farm wage rates are expected to average higher in 1938 than in 1937. A fairly high level of farm income and high hourly wage rates in non-agricultural industries will have a strengthening effect on wages of farm workers next year.

There has been a marked upward trend in farm wage rates since the spring of 1933, the annual increase averaging about 11 per cent. During the same period hourly wage rates in manufacturing industries have increased an average of 9 per cent a year.

Even if farm wage rates do not continue their sharp upward trend next year but make about the usual seasonal changes from now on, the 1938 average rate will be the highest since 1931.

Farm Machinery.

A rise in prices of farm machinery is expected in 1938, the increase being mainly due to increased costs of manufacture.

Tractor prices had declined 7 per cent from 1929 to 1933; but since that time increases have raised prices of tractors to a level of 3 per cent above 1929. The current higher wages and materials are likely to be reflected in some further price increases on farm machinery. Higher prices of automobiles for the 1938 models already have been announced by most manufacturers.

Fertilizer.

Retail prices of fertilizer during the 1938 season will average higher than a year earlier and probably the highest since 1931. The percentage of rise will not be very great, however.

Cotton.

At the beginning of the current season (August 1) the world was carrying the smallest stock of cotton in 7 years. During the year the world carry-over of American cotton had declined about 700,000 bales, which had more than offset an increase of 400,000 bales in the carry-over of foreign cotton.

Wheat.

The wheat situation in this country has been comparatively favorable to producers during the past season, with a fairly large crop being sold on a strong market.

The export situation may not be so favorable in the year beginning next July. World acreage will be large and, if yields are average, wheat production in 1938 will exceed prospective world requirements, and carry-over stocks in the summer of 1939 will again be large.

Some 81 million acres were seeded for this year's crop and if growers respond to relatively high prices as they have in the past there will be little change in the acreage seeded for the 1938 harvest. Abandonment this year was heavy, leaving a crop estimated at 887 million bushels. This country ordinarily uses about 660 million bushels a year; with average yields this could be produced on about 56 million acres.

Hogs.

The number of hogs slaughtered in the present marketing year, October through next September, is expected to be somewhat smaller than the 34 million head slaughtered in the previous year. It will be much below the average slaughter of recent years, which ranged from 41 million to 49 million head.

The average weight of hogs slaughtered this coming season will be heavier than last season, with the greatest difference coming in the first 4 or 5 months of the year. The average for the year probably will range from 230 to 235 pounds, compared with 220 pounds last season. The heavier average weights probably will about offset the expected decrease in number of hogs slaughtered.

Last spring's pig crop (38,779,000 head) was about 3 million head smaller than the crop of the previous spring. Except for that in 1935 it was the smallest in many years. Most of the reductions were in the western Corn Belt, reflecting the short corn production in that area in 1936.

5. Accuracy of the Reports

Are these reports accurate? This question has been raised on numerous occasions not only by farmers but by individuals and agencies interested in farming. The question is not easily answered, as both intentions and outlook reports are designed primarily as guides to farmers in making their production plans and in developing their production program. It is obvious that, if conditions forecast in each report for each year prove to be absolutely accurate, it would be prima facie evidence that the reports have not been used extensively. In other words, the wider the use of the reports, the less accurate the forecast would be. However, as relatively few farmers are sufficiently alert, conditions are not greatly modified by the action of farmers. Hence, it has been found that reports tend to compare favorably with actual conditions. Mr. Oris V. Wells has made a careful study of the outlook reports from 1924 to 1929, inclusive, for the purpose of checking the statements with subsequent developments. He found that the reports varied from 84 per cent correct in 1929 to as high as 94 per cent correct in 1926. The average score for the period was 87 per cent.

As a result of this study, Mr. Wells feels that so long as agricultural prices are not subjected to new economic influences, their behavior can be forecast with a fair degree of success. At any rate from past experiences it seems that these reports are sufficiently accurate to be used by farmers in planning their production program.

The intentions-to-plant reports have been as accurate as the outlook reports and indeed probably somewhat more accurate. In 1930, for example, farmers stated that they intended to increase their corn acreage 2.8 per cent over the preceding year. The intention and performance, as indicated by the acreage actually harvested in 1931, was very close not only for corn but for durum wheat, spring wheat, oats, and tobacco. For barley, flaxseed, rice, grain, sorghum, and potatoes the intention varied from performance from about 5 points in the case of flaxseed and rice to less than 3 points in the case of potatoes. On the whole, the intention to plant for 1930 was quite accurate; the acreage of specified crops averaged 5 per cent over the acreage for the preceding year; and the acreage actually harvested was 4 per cent over that for the preceding year.

The 1931 intentions report was not nearly so accurate as the 1930 report. In only two cases, namely, corn and tobacco, were the intentions to plant accurately carried out as indicated by the acreage harvested. In the remaining cases, except one, the acreage harvested was lower than the intentions-to-plant report indicated. This variation in the intentions and acres harvested might indicate that the farmers were making more intensive use of the reports in 1931 than in 1930. It should also be mentioned that variation between the intentions to plant and acres harvested of the various crops is probably correlated with changes which take place in the intentions to plant; thus an increase in the intentions to breed hogs might affect somewhat the number of acres of corn planted. A change from the intentions to plant tobacco, for example, might tend to increase other crops, especially feed crops. What ever the causes of these discrepancies between the reports and actual performances, the fact remains that the reports are valuable guides to farmers in planning their production programs.

6. How Reports May Be Used

In planning his production the farmer must act in one of three ways: (1) He can plan his farm operations on prices at planting time; (2) he can base his production program on anticipated or forecast prices; or (3) he can ignore all price forecasts; that is, he can plan his operation without reference to prices at planting time or to what they will be when his produce is ready for market. Of these three, the most typical reaction is to present prices. That is, farmers are more likely to react to prices at planting and breeding time than they are to anticipated prices. Smith found that the correlation to prices at planting time and the acreage subsequently planted to cotton was generally high.[2] When cotton prices were high at planting time, as compared with those of the previous year, the number of acres planted was greater. And conversely, when prices were low, the number of acres was low. Other investigators, especially Ezekiel, Bean, and Elliott, have found similar relationships in the case of other crops and livestock products. When the farmer reacts to prices at planting or breeding time, it is obvious that his income will tend to be low, largely because he may overplant or underplant, overbreed or underbreed. If he overplants or overbreeds, prices are likely to be low, sometimes excessively low, when the products are ready for market. On the other hand, if he underplants or underbreeds, the prices are high; but the quantity available for market is small, resulting in a low income. In either case, the farmer is not likely to get the maximum net returns.

The net income of farmers who pay no attention to price changes either present or future in planning and executing their production program will be about normal or somewhat below normal. In some years they will lose; in others, gain. But on the average their income will be about normal. Inasmuch as they do not react to high prices and plant more or breed more, they will have the same amount to sell on a low market as they have on a high market. If there is not a radical change in the trend of prices and costs, uniform production is a safe procedure for a few years and even for a longer period. If, however, the price of the major product is moving downward, cost remaining unchanged, the loss will be greater than the gain. On the other hand, if the price of the major product is rising, then the gains will tend to be higher than the losses.

---

[2] U. S. Department of Agriculture, *Technical Bulletin No. 50,* "Factors Affecting the Price of Cotton," by B. B. Smith.

It is quite obvious if the forecast price proves to be correct and if a farmer changes his production in anticipation of these prices, he will make more than if he follows a uniform scheme of production or changes his plan in response to prices at planting and breeding time. In the first case, he will have a relatively large quantity of produce to sell the prices of which are high, and a relatively small quantity of those things of which anticipated prices are low. In the second case, the reverse of this will be true—namely, that the farmer will have for sale large quantities of products the prices of which are low, and small quantities of the products the prices of which are high.

Questions

1. Why do farmers need advance information regarding market and price outlook?
2. What type of information is contained in: (a) outlook reports; (b) intentions-to-plant reports; (c) pig survey?
3. How would you, as an individual, make use of an intentions-to-plant report?
4. Have the outlook reports been sufficiently accurate in the past to indicate reliability in the information they give out to farmers? Explain.
5. State how farmers may use the outlook reports to adjust their production.

References

Idaho Agricultural Experiment Station Circular 62, "A Review of the Accuracy and Timeliness of Outlook Statements," by C. O. Youngstrom, 1932.

U. S. Department of Agriculture, "Discussion of Price Forecasting," Mimeographed, Bureau of Agricultural Economics, January 26, 1928.

U. S. Department of Agriculture, "A Comparison of Outlook Statements with Subsequent Events," Mimeographed, by Oris V. Wells, January 24, 1930.

CHAPTER XXII

Farm Records

IN ADDITION to the facts supplied by economic reports, as discussed in Chapter XXI, the farmer or farm manager needs also accurate information regarding the operation of his farm. The first type of information may be termed *external;* and the second, or that obtained from the farm, *internal* data. These two types of information supplement each other. It is obvious that data on prices, market demands, supplies available, price and production trends, and similar information are needed as long as the farmer produces for the market. But data of this type alone are not sufficient. If the farm is to be organized and operated so as to obtain maximum net returns, the manager needs to know the results obtained from specific operations and from specific enterprises. He will need to know also the financial results of operations of the farm as a whole. If this information is to be obtained, then the manager must keep farm records and accounts. This chapter will be confined to a discussion of farm records, and Chapter XXIII to farm accounts.

1. Records and Accounts Defined and Described

First, however, a distinction needs to be made between a record and an account. A record, as the name implies, is a statement containing data on a *specific* subject. Records may be of various types. They may be financial, involving the use of money as such, or they may be statistical in character. An account, on the other hand, is a financial statement that is an integral part of a system of accounts. The distinction between these two concepts may be made clear by an illustration. For example, a statement containing information on cash receipts and cash expenditures, if it is not an integral part of a system of accounts, may be called correctly a cash *receipt and expenditure* record. But when such a statement is called an account, it is implied that it is an integral part of a system of accounts.

Records and accounts are interrelated to the extent that the data contained in a record may be transferred to a specific account. Thus, the data from a *feed record* may be transferred to a *feed account.* Indeed, it is seldom possible to keep a system of accounts without also keeping a number of specific records.

2. Kinds of Farm Records

Farm records are of several kinds. The number and the form to be used will depend upon the type of farming and the extent to which detailed information is required. Normally farm records may be classified as follows: (a) Property; (b) Labor; (c) Feed; (d) Production; (e) Materials; (f) Field; and (g) Miscellaneous. These major records will be described and a form suggested for each.

a. *Property record.* It is customary to begin a discussion of this subject with a description of a farm property record or inventory. This record, one of the most useful of all farm records, consists of a classified list of all farm property, such as real estate, machinery and equipment, livestock, and feeds. Occasionally it may be necessary to keep a record of such things as growing crops. In some cases, also, a record is kept of the cash on hand which is used strictly for farming operations, notes, and accounts receivable. These items will be considered in more detail in Chapter XXIII.

Each of these major classifications is, as a rule, divided into minor categories. For example, real estate is divided into land and buildings. A further breakdown is usually desirable. Buildings can be listed as dwellings, tenant houses, and other types of buildings found on the farm.

FORM 1

CONTINUOUS FARM PROPERTY RECORD

Farm of____________________
Address____________________

A. *Real Estate*

Land or Building	Date____________ ____				Date______ ____		Date______ ____	
	Number	When Acquired	Price per Unit	Value	Price per Unit	Value	Price per Unit	Value

B. *Machinery and Equipment*[1]

Kind of Implement	Date____________ ____				Date__________	Date__________
	Number	When Acquired	Original Cost	Present Value	Present Value	Present Value

---

[1] Columns may be provided for estimated total life and annual depreciation.

C. *Livestock*[2]

Class or Kind of Livestock	Date________________ ____					Date______________ ____			
	Number	Age	Weight	Price	Value	Number	Age	Weight	Value

---

[2] Column may be provided for the name of the animal where this is desirable or necessary.

D. *Feed and Supplies*

Feed or Supplies	Date__________		Date__________		Date__________		Date__________	
	Amount	Value	Amount	Value	Amount	Value	Amount	Value

E. *Growing Crops*

Crop	Date____________ ____					
	Acres	Cost				
		Seed	Fertilizer	Labor	Other	Total

Land may be recorded as cropland, pasture, woodland, idleland, and wasteland. Each of the minor classifications can be further subdivided if necessary. The extent of the subdivision depends upon the importance of the major property item.

The following scheme is presented to illustrate how farm property may be classified for the purpose of keeping a complete record. A detailed classification has been omitted, since the lesser categories will vary from farm to farm.

I. Real Estate
  1. Land
  2. Buildings
  3. Fences
II. Equipment
  1. Power equipment
  2. Horse-drawn equipment
  3. Miscellaneous
III. Livestock
  1. Workstock
  2. Cattle
  3. Swine
  4. Sheep
  5. Poultry
IV. Feeds, Seeds, and Supplies
  1. Feeds
  2. Supplies
  3. Seeds
V. Growing crops[*]
  1. Small grains
  2. Hay crops
  3. Other crops
VI. Other Classes of Farm Property or Assets
  1. Cash on hand used for farm purposes
  2. Notes receivable
  3. Accounts receivable

For the purpose of keeping a farm property record, it is not necessary for a farmer to go to any great expense in the purchase of special forms. An ordinary notebook 7″×12″ will usually suffice for this purpose. Such a notebook may be ruled so as to provide space for the name and description of the property, a column to record the number of items in a given category, a column for the price per unit, and finally a column for the total value, that is, the price per unit times the number of units. (See Form 1, A. B. C. D. E.)

On the second page, facing the first page of such a book, similar columns may be provided to record the property for subsequent years. By trimming the pages so as to leave visible the list of items, it is possible to use this book for a number of years without rewriting or relisting the items of farm property. If such a scheme is used, it will be desirable and necessary to leave a few lines under each major category so as to provide space for new entries.

---

[*] Growing crops are usually recorded as the cost of the seed, fertilizer, and labor used.

A farm property record book should be properly indexed. This can be accomplished by using ordinary paper or cloth tabs upon which is written the subject to which the tab refers. Thus, one tab would be marked "land", another "buildings", and another "livestock", or possibly one would refer to some subdivision of a given class of farm property.

Fig. 54. The keeping of records and accounts is made easier when the whole family becomes interested in the results.

A farm property record book will be made much more serviceable if care is exercised in describing each item of property. Such a description is useful in calculating the depreciation and in estimating the present value, as well as in supplying other useful information. The extent of the description will depend upon the nature of the object. In the case of land, the date purchased and the purchase price should be recorded. A description of the buildings or improvements should include the year built, the cost, and the size of the building erected or purchased. In recording livestock it is a good practice to give the name of each important animal, its age, weight, and price paid, if it has been purchased; if not, then the estimated value of each head of livestock should be inserted. Implements should be listed, as a rule, separately and each item should be accompanied by a description giving the type, size, date purchased, and cost.

The chief difficulty associated with the farm property record is not the classifications of the property or the method of recording them, but rather the valuation of each item. The necessity of using conservative values cannot be overestimated. If values too high or too low are used, the results obtained will be misleading. It is not possible to enter into a detailed discussion of the methods which might be used in evaluating farm property. For information on this subject the student is referred to any standard work on farm accounting. All that needs to be said here is that conservative values should be used and major changes in the value of items of farm property should not be made during any accounting period.

b. *Labor record.* This record is designed to show how all the labor, whether hired or family labor, is used on the farm. It is also used to keep a record of the horse power, tractor power, and the type of equipment used in performing the various farm operations. Such a record is illustrated in Form 2, which provides for the time of day the labor is employed, the task being performed, the type of equipment used, the number of man hours and horse hours worked, and the amount of work done. It also provides for the field number on which the operations are performed. This is a complete labor record. The data may be tabulated for any time span, such as by 30-minute intervals, by the day, by the week, or by the month.

FORM 2

Daily Labor Report

Farm of____________________

Day of Week________ Month________ Year________

Time	Kind of Work	Field or Crop	Kind and Size of Machine Used	Man Hours	Horses		Tractor Hours	Amount of Work Done (acres, loads, tons)
					No.	Hours		
4:30 5:00 5:30 6:00 6:30 7:00 7:30								
– –								
– –								
12:00								
12:30 1:00 2:00								
– –								
– –								
4:30								
– –								
– –								
9:30								
Total hours								

Name of workman: ________________

Remarks:____________________

Wage rate:________________

Report approved by:

____

Proprietor

A record of this type is not difficult to keep. The record may be printed in book form and of such a size as to be carried conveniently by each farm laborer, who indicates the time a specific task is started and ended by the simple act of drawing lines across the face of the record. For example, the regular daily work or chores may start at 4:30 A.M. and end at 5:30 A.M., when milking is begun. This task is finished at 6:30 A.M. When field work which may involve the use of equipment is done, the type of machine or implement used is stated in space provided for this purpose. The final column is used to record the work performed, such as the acres plowed or the number of loads of hay harvested.

When such a record is used, it is important to *account for all the hours of the work day.* For example, if no work is done, this fact should be recorded in just the same way as labor spent on a specific enterprise. The reason why no work was done should be stated. If a workman is sent to town or to market, this should be recorded. In case of holiday or a fishing trip, the incident should be written on the face of the record: "Went Fishing" or "Went on a Picnic."

On large farms the daily record should be signed by the individual laborer and examined and approved by the manager or the owner. When the record is kept by the manager, the record should be checked with the laborer to avoid any errors or misunderstanding regarding what was done and how long it took to do a specific task.

c. *Feed record.* The object of this record is to show the disposition of the feeds produced on the farm and the feeds bought. Unlike the labor record, the feed record need not be kept daily. It is usually sufficient to determine by weighing the amount of each kind of feed fed to each class of livestock at stated intervals, such as the first and fifteenth of each month, or whenever the type and amount of feed fed are changed. To obtain the total amount of feed fed for any given period, it is only necessary to multiply the amount fed per day by the number of days in the period. To illustrate how such a record may be kept, reference is made to Form 3.

The stub of this form is used to write the necessary items on which information is needed. These are: (1) amount of feed on hand at the beginning of the period; (2) feed purchased; and (3) feed raised on the farm during the period. The sum of these three items gives (4) the total supply available for disposition. There are two ways in which the total supply may be used. It may be fed to livestock, or it may be sold. The total fed to different classes of livestock is indicated in (5) and that sold in (6). The total supply available (4) less the amount fed (5) and the amount

FORM 3

MONTHLY FEED RECORD

Month of January, 194——.

Farm of____________________

Address____________________

Item	Corn Bu.	Oats Bu.	Wheat Bu.			Hay Tons	Commercial			
Supply 1. On hand beg. of month										
2. Purchased										
3. Raised										
4. Total supply										
Disposition Workstock										
Cows										
Swine										
Poultry										
5. Total										
6. Sold										
7. On hand at end of month										
8. Shrinkage or loss										

sold (6) should equal the amount on hand at the end of the period. But because of shrinkage, or destruction by rodents or weevils, it is necessary to determine the amount on hand at the end of the period. The difference between amount actually on hand and the calculated amount which should be on hand gives the shrinkage or loss.[1]

Feed records for a specific livestock enterprise are often desirable, especially for an enterprise which is making an important contribution to the farm income. The scheme of such a record will be the same as the general or over-all feed record, but the form will be somewhat different. Form 4 is an illustration of a monthly poultry record. This record

FORM 4

Monthly Poultry Feed Record

Month____________ Year, 194____. Farm of____________________

Feed Used

Feed	1 On hand 1st of mo. Lbs.	2 Bought Lbs.	3 Produced on farm Lbs.	4 Total supply (1,2,3) Lbs.	5 On hand last of mo. Lbs.	6 Feed used (4-5) Lbs.
Laying mash						
Starting and growing mash						
Scratch						
Corn						
Wheat						
Oats						
Oyster shells						

---

[1] Or, if shrinkage is estimated, the difference will indicate error in calculating amount fed.

provides for the feed on hand at the beginning of the month, amount purchased, total supply available, feed used during the month, and the amount on hand at the end of the month.

d. *Production records.* The purpose of these records is to record the details of crop and livestock production. When both crops and livestock are important enterprises on the farm, two records should be kept—one for crops and one for livestock. Forms 5 and 6 illustrate these two types of records. In some cases special production records are necessary or desirable. This will usually be true if the enterprise is an important one on the farm. Form 7 illustrates a production record for a poultry enterprise. It provides for a daily record of the eggs produced, disposition of the eggs, hens sold, and hens which died during the month. At the end of the month the information may be summarized and the accuracy of the data determined. If the daily count

FORM 5

CROP PRODUCTION RECORD

Year__________ Farm of____________________

Crop	Acres	Yield	Production	Disposition	
				Sold	Farm Use

FORM 6

LIVESTOCK PRODUCTION RECORD

Year__________ Farm of____________________

Product	Unit	Production	Disposition	
			Sold	Farm Use

FORM 7

Daily Poultry Record

Month of__________ Year______ Farm of__________

Breed of hens__________

Day	Eggs				Hens				
	Production Number	Used on Farm Number	Sold		Used on Farm		Sold		Died
			Number	Value	Number	Value	Number	Value	
1									
2									
3									
4									
- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
30									
31									
Total									

Produced during month.................. ______
On hand first of month.................. ______
1. Total supply.................................... ______
Marketed.. ______
Used on farm....................................... ______
On hand last of month........................ ______
2. Total disposition............................. ______
Short or over (1 minus 2)..................... ______

Birds on hand beginning of month.................. ______
Less hens sold................................ ______
Less hens died................................ ______
On hand end of month... ______
Average for month.. ______
Number eggs per bird.. ______
Per cent of birds in lay.. ______

of eggs is accurate, then the total supply produced and on hand at the beginning of the month should be equal to eggs sold, used, and on hand at the end of the month. From a record of this sort control can be exercised over the reporting and disposition of the product. (See also Form 8 for a daily report on milk production.)

e. *Materials record.* When materials, such as seeds, fertilizer, and spray materials, are used in large quantities, it is always desirable to have an accurate record as to how these have been used, the amounts purchased, and on hand. (See Form 9.)

f. *Field records.* One of the most useful and informative types of records which a farmer can keep relates to his field operations. One reason why this is true is that the treatment of the soil and type of rotation of crops directly affect yields. For these and other reasons, such as types of soil-borne diseases and mineral deficiencies, some sort of field record should be kept. Records for this purpose are of two types. A record may be kept on each field (Form 10), or the record may include all crops (Form 11). The first of these records shows the crops grown annually on a specific field, yield of the crops, soil treatment, such as kind and amount of fertilizer used, and any special treatment that the soil may require to make it productive. According to Form 11, all the crops are reported in a single report for a given year. The information is the same as in Form 10, but for a comparison of the results for several years the information for a specific field would have to be reassembled.

g. *Miscellaneous records.* There are other records which, under special circumstances, a farmer may find advisable. A breeding record is almost indispensable on livestock farms. Such a record should provide for the name of the dam, the sire, date bred, due, and the date the young were dropped. An incubator record is needed if a farmer is engaged in hatching eggs, either for his own use or for the sale of day-old chicks. A machinery record will be found useful when a farmer is doing custom work or is using

FORM 8

DAIRY PRODUCTION RECORD

Year________ Farm of________________

Grade________ Milk sold to________________ Station________________

Month	Farm Use Lbs.	Basic Production		Surplus Production		Milk Sold							
		Lbs.	Price	Lbs.	Price	Lbs.	Price	B. F. Test %	Value	Deductions			Net Value
										Hauling Cost $		Other Costs $	
Jan.													
Feb.													
Mar.													
Dec.													

FORM 9

Materials Record

Date________ Month ________ Year

Farm of________

	Fertilizers (tons)					Seeds (bu.)					Sprays (lbs.)		Other	
	4–8–4	2–10–6				Wheat	Oats	Corn			Arsenic		Lime	
1. On hand beginning period														
2. Purchased														
3. Total supply														
Disposition:														
Corn														
Wheat														
Oats														
Potatoes														
....														
....														
....														
4. Total used														
5. On hand at end of period														
6. Shrinkage or not accounted for														

heavy equipment on his own farm. A record of this sort ought to provide for the type of machine used, time used, fuel bought, repairs, and the hours of man labor, with additional columns to be used to record other items of cost. Not infrequently a record of the farm products used in the home is needed, especially if the value of these products is to be used in calculating total farm income. Such a record should be kept daily and should provide a column for each of the major products used in the home.

FORM 10

FIELD RECORD

Date__________ Farm of__________

Field No._____ Size_____ Soil Type_____ Topography_____

Year	Crop	Yield (bu.)	Treatment	
			Type	Amount of materials used

FORM 11

FIELD RECORD

Date__________ Farm of__________

Crop	Field No.	Acres	Soil Type	Topography	Treatment	
					Type	Amount of materials used

3. Summary—the Function of Records and Accounts

The chief function of records and accounts is to provide accurate information on the farm operations. The facts thus provided may be used by the manager to adjust current operations and to develop a more effective farm plan or organization. In addition to these two uses, specific records may be of some historical value, such as the *breeding* record, which will show the animals bred, name of sire and dam, as well as other pertinent information.

To be most useful, records and accounts should be kept on all phases of the farm business. The magnitude of this task is illustrated in Fig. 55, which shows schematically the type of accounts and their relationship to each other and to the business as a whole.[2] Much of the information which is required for such a system of accounts must be obtained from records. This is especially true of the information needed for the *operating* and *productive* accounts. From a system of accounts of this character the farmer could obtain all the information needed to show the net loss or gain on each enterprise, his labor cost per hour, the cost of his equipment used per hour or per acre, the number of horse hours required per acre or unit of output of specific products, as well as other useful information. Then, by careful analysis of such data, the farmer can adjust his operations or revise his system of farming so as to use his available resources more effectively.

It is hardly ever desirable, however, unless a farmer is operating a large business, to keep such an elaborate set of accounts. But this should not be made an excuse for not keeping some farm records and a *simple* set of farm accounts. Farm records, even if they are not related to farm accounts, may be made to yield valuable information. Suppose, for example, the farmer is maintaining a poultry enterprise as a part of the farm business. He can, by keeping an enterprise record, determine the extent to which this enterprise is a profitable one. Such an enterprise record would require the collection of information on eggs produced, eggs and poultry sold, quantity of each used in the home or for other purposes. It would also require such information as the amount and kind of feeds fed, feeds bought, the number of hours and cost of labor used, and an inventory of birds on hand at the beginning and end of any given period.

---

[2] Hopkins, John A., *Farm Records*. Ames: The Iowa State College Press, p. 94.

Questions

1. What is meant by external and internal data when applied to the farm?

2. Distinguish between a record and an account.

3. What is the chief function of farm records and accounts?

4. How can information obtained from farm accounts and records be used?

5. Name the classes of farm accounts and describe the nature of each.

References

Hopkins, John A. *Farm Records.* Ames, Iowa: The Iowa State College Press, 1942. Chapters 3, 4, 5, 6, and 7.

U. S. Department of Agriculture, Bureau of Agricultural Economics, *Farmers' Bulletin 1962,* "Useful Farm Accounts." 1944.

————, Bureau of Agricultural Economics, *Farmers' Bulletin 1181,* "Farm Inventories." 1921.

CHAPTER XXIII

Farm Accounts

MOST farmers keep some records of their farming operations. True, these records are often in the form of notes or memoranda and are often incomplete. Not only are they incomplete, but often they are not recorded in a systematic fashion. The failure of the farmer as a bookkeeper or as an accountant stems from two things: He does not realize, as a rule, the value of accounts; and he is more or less bewildered by the terms used and the procedures followed. As a result, he usually will resist or belittle any suggestion to the effect that he should keep systematic accounts. If he *is* induced to do so, he may after a short period throw the whole thing overboard as a bad job, using such adjectives as he can think of on the spur of the moment to describe accountants in general and a few in particular.

Unfortunately for the farmer and for those who may have to assist him in setting up a set of accounts and instructing him how to keep them, there is no easy road to follow. There are short cuts, to be sure, but accounting, as the performance of many tasks, requires that certain principles and procedures be observed. It is the purpose of this chapter to illustrate how these principles and procedures can be put into use, and to indicate some of the results that may be obtained.

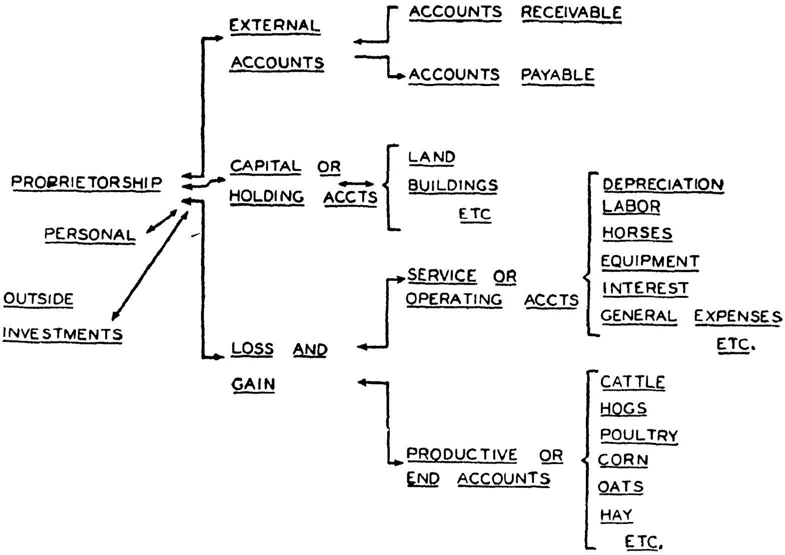
1. The Nature of Simple Farm Accounts

There is nothing mysterious about accounting or bookkeeping. Accounting is simply a systematic procedure designed to reveal the essential facts of the operation of a business enterprise. The actual keeping or recording of transactions in any system of accounting is called bookkeeping. To explain the nature of these, insofar as they apply to farming, it will be necessary to consider the essential elements of accounting, such as the scheme and function of accounts, methods used in recording business transactions, and some essential bookkeeping and accounting terms and concepts. This procedure is essential if the reader is to obtain a clear grasp of this important subject. It should be kept in mind, however, that this is not a complete discussion of accounting or bookkeeping. There are many problems of accounting which cannot be considered here. Nevertheless, enough will be said so that a clear conception may be acquired of the nature of accounts and how they may be used in farming.

a. *Scheme and function of accounts.* Since the purpose of keeping accounts is to furnish the management with accurate information regarding the operation of the business, it is necessary first of all to consider the number, arrangement, and function of the accounts which need to be included in any system of accounts. Usually accounts are divided into three major groups: (1) *External;* (2) *Capital* or *Holding* Accounts; and (3) *Loss* and *Gain* Accounts.[1] (See Fig. 55.) This classification is significant. The external accounts are essential because any modern business enterprise is not self-contained. It must do business or have business dealings with outside firms or individuals. Hence, these external accounts are used to record receivables, or amounts owed to the business by persons or firms, and payables, or amounts owed by the business to others. The capital or asset accounts are provided so that the management can keep informed as to the conditions of such things as land, buildings, machinery and equipment, supplies, or other assets. The loss and gain account is designed to assemble the results of farm operation which "flow" into the loss and gain account from service or operating activities, such as labor and horses, and productive enterprises, such as crops and livestock. It should be emphasized that all these accounts center on the proprietor, because he is responsible for the operation of the business.

---

[1] Hopkins, John A., *Farm Records,* Chap. 10.



Courtesy of The Iowa State College Press

Fig. 55. Diagrammatic presentation of farm accounts.

b. *Books of accounts.* Conventionally the business transactions are recorded in certain books known collectively as *books of accounts.* They are the *Daybook, Journal,* and *Ledger.* Actually these are not always books, since transactions may be recorded in memoranda or on specially designed forms. Nor is it necessary that all these books be used in a system of accounting. This is especially true of the Daybook, which is often omitted, and the transactions are either entered in the Journal or posted directly to the Ledger.

Each book has a specific function. In the Daybook, when it is used, the transactions are recorded chronologically. No attempt is made to classify them or to designate either their importance or disposition. On the other hand, the Journal is used to designate the disposition of each transaction, *i.e.*, to show the ledger accounts to which each item is posted. The Ledger is used to classify transactions according to specific accounts. By the use of these books, the transactions are recorded, identified, and classified. In this manner the data are transformed from a nonusable to a highly usable form.

c. *Accounting and bookkeeping terms.* In recording transactions certain terms are used to designate specific things and to facilitate the accurate recording of the information in the several books of accounts. The more important of these terms are defined as follows:

(1) An *account* is a ledger exhibit of financial transactions relating to a specific person, a corporation, a thing, or to a group of things, or to any other single aspect of a business.
(2) A *transaction* may be defined as any exchange of goods or services.
(3) An *asset* is anything of value belonging to or owned by a person or firm.
(4) A *liability* is a debt which is owed by a firm or person to some other person or firm.
(5) The word *debit* refers to an entry made on the *left* side of a ledger account; the word *credit* refers to an entry made on the *right* side of a ledger account.
(6) *Journalizing* means the act of making entries in the Journal.
(7) *Posting* refers to the act of transferring transactions listed in the Journal to the proper ledger accounts.

d. *How to distinguish between debit and credit.* Usually it is not difficult to distinguish between a debit and a credit entry. There are, however, some cases in which this may not be an easy task. Generally, when a ledger account assumes responsibility for a given item, it is debited, *e.g.*, when the cash is received from the sale of a good or an asset, the cash accounts assume the responsibility for this cash until it is paid out. When, therefore, cash is paid out, the cash account is credited with the sum paid, or the cash account gives up its responsibility. Using this general principle of responsibility, the following directions will be helpful in deciding when an account should be debited or credited:

Debit an account when there is:

(1) An increase in assets, *e.g.*, receipt of cash.
(2) A decrease in liability, *e.g.*, payment of a debt.
(3) A decrease in ownership, *e.g.*, when capital is withdrawn or losses are incurred.
(4) An expense incurred, e.g., when fertilizer is bought the fertilizer account is debited; if cash is paid out, the cash account is credited; if the fertilizer is bought on account, then accounts payable is credited.

Credit an account when there is:

(1) A decrease in assets, *e.g.*, when cash is paid out.
(2) An increase in liability, *e.g.*, when a debt is incurred.
(3) An increase in ownership, *e.g.*, when capital is added to the business.
(4) Income received, *e.g.*, when cotton is sold, the cotton account is credited; if cash is received, the cash account is debited; if the cotton is sold on account, then accounts receivable is debited.

e. *How the various books of accounts are used.* The act of recording transactions is simple enough. When the Daybook is used, the exact nature of the transaction is accurately recorded at the time it occurs. Suppose, for example, that a farmer who is keeping farm accounts sells for cash 10 bales of cotton on January 1, 1944, and suppose, further, that he made a purchase on account of 10 tons of fertilizer. These two transactions would appear in the Daybook somewhat as follows:

Daybook

Date	Transaction	Amount
1944 1/1	Sold to John Davis, cotton buyer, for cash 10 500-lb bales of cotton @ 25¢ per lb.	$1,250
1/1	Bought of Weil Bros. 10 tons of 2–8–6 fertilizer @ $30 per ton. Payable 10/15/44.	300

These entries give all the information needed, the things sold or bought, the name of the firm or person involved, and the date on which each transaction was consummated.

It is obvious, however, that when the number of such entries is large, the farmer will find it difficult to get an accurate, if indeed any, idea as to the total sales or purchases or as to the sales or purchases of specific things. To obtain a clear idea with respect to all the aspects of his transactions, it is necessary to perform two other tasks: (1) Journalize the Daybook items; and (2) post these items to the appropriate ledger accounts. The first of these two tasks is illustrated in the following form in which the same items appearing in the Daybook are journalized:

Journal

Date	Explanation	Number of Ledger Account	Debit	Credit
1944				
1/1	Cash	111	$1,250	
	Cotton	412		$1,250
	Sold 10 500-lb. bales of cotton to John Davis			
	....			
1/1	Supplies	56	300	
	Weil Bros.	2122		300
	Bought on account of Weil Bros. 10 tons 2-8-6 fert. Payable 10/15/44			
	.. . .			

When the items have been journalized, they are then ready to be transferred to the Ledger, which is used to bring together related transactions, so that the farmer may be able to determine the situation quickly with respect to any aspect of his business. From the information set forth in the sample Journal, four accounts are involved: (1) Cash; (2) Cotton; (3) Supplies; and (4) Account(s) Payable. These four accounts will appear somewhat as follows after the items in the Journal have been posted:

Ledger

Cash 111

Date	Memo	F	Debit	Date	Memo	F	Credit
1/1	10 bales of cotton		$1,250				

Cotton 412

Date	Memo	F	Debit	Date	Memo	F	Credit
				1/1	10 bales of cotton sold to John Davis		$1,250

Supplies 56

Date	Memo	F	Debit	Date	Memo	F	Credit
1/1	10 tons 2-8-6 fert.		$300				

Weil Bros. 2122

Date	Memo	F	Debit	Date	Memo	F	Credit
				1/1	10 tons 2-8-6 fert.		$300

A ledger account is divided into two parts: Debit and Credit. This is a distinct departure from the form of the Daybook. For each part there is a column for the date when the transaction took place, another marked "Memo" to make any note regarding the transaction and F(olio) to index the page in the journal where the entry can be found. Since each item or transaction is entered twice, the ledger accounts should always be in balance.

f. *Numbering the accounts.* It is always convenient and sometimes necessary to number each ledger account. This is to facilitate tracing an entry to its source and to avoid mistakes in entry, or to assist in discovering any error which has been made. There are, of course, various ways of numbering accounts. If the exact number of accounts is known in advance, successive numbers 1, 2, 3, et cetera will suffice. But often new accounts must be added from time to time. If so, then the *Dewey Decimal System* is perhaps the most effective method to use.[2] Normally there are five classes of accounts: (1) assets, (2) liabilities, (3) proprietorship, (4) income, and (5) expenses. To these others may be added, such as nonoperating income and nonoperating expenses.[3] This system of numbering provides the possibility of using the first digit on the left of any number to indicate the "general class" (*i.e.*, one of the five or seven classes already named) to which the account belongs; whereas the second digit may be used to indicate the subclass; and finally the third digit to indicate any other subdivision of any one of the general accounts which may be required. Suppose an account was given the number 1112; what would this mean? Assuming that assets were assigned the number 1, then it would be known that this number involved *assets* in some way. Let it be supposed that the second digit is used to designate *current assets.* Now, there are several kinds of current assets, such as cash, crops on hand, livestock, indeed any assets which can be easily liquidated or sold. If cash is the current asset account to be numbered, then the *cash* account would carry the number 111. But cash may be in the form of currency or money on hand or money deposited in the bank. The *type of cash* may be designated by a number, in this case by the number 2. The 2 might refer to money on deposit subject to check. This, then, explains fully the meaning of 1112. The first 1 tells us that it is an asset; the next digit, that it is a current asset; the third digit, that it is cash; and the fourth digit, that it is cash subject to check.

---

[2] McMurry, Karl F., and McNall, Preston E., *Farm Accounting.* New York: A. W. Shaw & Company, p. 92.

It is obvious that this system of numbering is flexible since each number can be expanded to indicate types of accounts, and each subtype can be extended by adding another digit; in this case 111 can be expanded to 1111, 1112, 1113, et cetera. In this manner a set of accounts can be enlarged or reduced without interfering with the original numbering of the other accounts.

---

[3] See page 403 for classification.

2. A Set of Simple Farm Accounts

To illustrate how the theory and techniques of bookkeeping and accounting, discussed in Section 1, can be applied, data from an actual farm will be used. This information covers the year from January 1 to December 31, 1945.

The farm consists of 130 acres of land and is located on an improved highway seven miles from a city with a population of 50,000. It is in this city that the owner markets all his crops except tobacco and buys most of his farm supplies. His principal cash crops are cotton and tobacco. Other crops produced are corn, soybeans, sweet potatoes, and hay. He operates a poultry enterprise of over 500 birds. In 1945 the land on this farm was distributed as follows:

Crops	*Acres*	*Other Land Use*	*Acres*
Corn	30.0	Woodland	38.0
Cotton	5.0	Pasture	15.0
Tobacco	6.0	Roads, fences, and farmstead, and other land	12.0
Oats for grain	5.0		
Wheat for grain	14.0		
Cowpeas for hay	(5.0)		
Sweet potatoes	5.0		
Lespedeza hay	(14.0)		
Total cropland	65.0	Total land in farm	130.0

This farm is operated by the owner with the assistance of one regular hired man. Seasonal labor to barn tobacco and pick cotton is hired as needed.

First the records will be presented in the conventional manner, which is well suited to a consideration of theories and techniques of accounting. Then the same data will be given in a different way, one much better suited to farm conditions—especially so if the farmer is keeping his own set of accounts.

a. *Name and number of accounts.* For the purpose of discussing the problem of keeping the accounts on this farm, it will be necessary to classify the accounts and to give each account a number. The Dewey Decimal System, discussed in Section 1, is used in numbering the accounts. The accounts are divided into five major categories: (1) Assets, (2) Liabilities, (3) Proprietary Interest, (4) Income, and (5) Expenses. Each major division has been subdivided according to the needs of this particular set of accounts. The classification showing the details is as follows:

Classification of Accounts

1. *Assets*
    - 11 Current
        - 111 Cash
        - 112 Feeds, crops, and supplies inventories
        - 113 Livestock inventories
    - 12 Fixed
        - 121 Land
        - 122 Buildings—Improvements
        - 123 Machinery and equipment
        - 124 Growing crops inventories
2. *Liabilities*
    - 21 Current
        - 211 Notes payable
        - 212 Accounts payable
            - 2121 Job P. Wyatt and Sons
            - 2122 Weil Brothers
    - 22 Fixed
        - 221 Farm mortgage
3. *Proprietary Interest*
    - 31 Albert Jones—Investment
    - 32 Profit and loss
    - 33 Personal
4. *Income*
    - 41 Sale of crops
        - 411 Tobacco
        - 412 Cotton and cottonseed
        - 413 Feed and grain crops
    - 42 Sale of livestock and livestock products
        - 421 Poultry and eggs
    - 43 Miscellaneous income
        - 431 Dividends, AAA payments and discounts
5. *Expenses*
    - 51 Building repairs
    - 52 General farm expenses
    - 53 Equipment expenses
    - 54 Truck expenses
    - 55 Seed
    - 56 Crop supplies
    - 57 Poultry feed
    - 58 Poultry supplies
    - 59 Wages and labor
    - 591 Crop expenses
    - 592 Improvements expense
    - 593 Depreciation
    - 594 Feeds, crops, and supplies (Adjustment account)
    - 595 Livestock (Adjustment account)
    - 596 Growing crops (Adjustment account)

b. *Inventory and financial statement.* The starting point in keeping any set of accounts is the inventory, or a classified list of the farm assets at a given time, expressed in terms of value. These assets are land, buildings, equipment and machinery, livestock, feeds and supplies, growing crops, cash on hand, accounts and notes receivable, or any other type of property which is used in or is concerned with the operation of the farm. (See Chapter XXII, Sec. 2.)

In contrast to the assets are such things as mortgages and notes and accounts payable, which are called liabilities. These are obligations of the business or are debts owed by the business to outside firms or individuals. From these two sets of data a financial statement can be constructed. Such a statement as of January 1, 1945 for the farm which is used in this set of accounts is as follows:

Financial Statement, Jan. 1, 1945

	Assets		
	Cash on hand	$ 500.00	
	Land	3,405.00	
	Buildings	4,690.00	
	Livestock	793.00	
	Equipment	934.00	
	Feeds, crops, and supplies	777.00	
	Growing crops	114.00	
(1)	Total assets		$11,213.00
	Liabilities		
	Mortgage	$3,557.00	
	Notes payable	173.00	
	Accounts payable	130.00	
(2)	Total liabilities		$ 3,860.00
(3)	Net worth (1 minus 2)		$ 7,353.00

What, it may be asked, do these data mean in the scheme of accounting? First, they show the assets and the liabilities, their nature and value; second, they indicate the solvency of the business at the beginning of the accounting period. This information is obtained by subtracting the total liabilities from the total assets. The difference is called the *net worth,* or the equity which the owner has in his business. If the value of the assets exceeds the outstanding debts, the business is solvent; if the reverse of this is true, then the business is insolvent.

c. *Journalizing the assets, liabilities, and net worth.* These things must all be recorded in the books of accounts. This procedure is referred to as "opening the books." The Journal is used for the purpose of recording the assets, liabilities, and net worth, and the Daybook is used for recording the current business transactions. The current transactions are also entered in the Journal. In order to distinguish between these two types of entries, the first, or the assets and liabilities, is called the *opening entries* and the current transactions, the *current entries.* Later, when closing the accounts, it will be necessary to use the terms *adjusting entries* and *closing entries.*

For the purpose of explaining how the books are opened and the current transactions recorded, the data for the first month of 1945 are used. The transactions for all other months have been summarized and entered in the Ledger as monthly totals. The journal entries are as follows:

Journal

December 31, 1945

Date		Explanation	Folio	Debit	Credit
1945		*Opening Entries*			
January	1	Cash	111	$500.00	
		Land	121	3,405.00	
		Buildings—Improvements	122	4,690.00	
		Livestock	113	793.00	
		Equipment	123	934.00	
		Feeds, Crops, and Supplies	112	777.00	
		Growing Crops	124	114.00	
		Mortgage	221		$3,557.00
		Notes Payable	211		173.00
		Accounts Payable	212		130.00
		Proprietorship (net worth)	31		7,353.00
		Current Entries			
	6	Cash	111	41.95	
		Poultry and eggs	421		41.95
		95⅓ dozen eggs @ 44¢			
	8	Cash	111	24.00	
		Sweet potatoes[a]	413		24.00
		12 bushels sweet potatoes @ $2.00			
	13	Cash	111	45.32	
		Eggs and poultry	421		45.32
		103 dozen eggs @ 44¢			
	13	Cash	111	587.20	
		Tobacco	411		587.20
		1468 lbs. tobacco @ 40¢			

---

[a] Inventoried with feeds, crops, and supplies.

Date	Explanation	Folio	Debit	Credit
1945	(*Current Entries* continued)			
January 20	Cash	111	90.20	
	Eggs and poultry	421		90.20
	205 dozen eggs @ 44¢			
26	Cash	111	48.00	
	Sweet potatoes	413		48.00
	24 bu. sweet potatoes @ $2.00			
26	Cash	111	51.36	
	Eggs and poultry	421		51.36
	203 lbs. of poultry @ 25.3¢			
27	Cash	111	64.24	
	Eggs and poultry	421		64.24
	146 dozen eggs @ 44¢			
30	General farm expense	52	4.50	
	Cash	111		4.50
	Electricity $3.00; Telephone $1.50			
	General farm expense	52	6.00	
	Cash	111		6.00
	Legal service			
	Building repairs	51	62.79	
	Cash	111		62.79
	8102 B.F. of lumber @ $7.75			
	Poultry feed	57	96.00	
	Cash	111		96.00
	2400 lbs. of laying mash @ $4.00 per cwt.			
	Poultry supplies	58	14.50	
	Cash	111		14.50
	1000 egg cartons			
	Poultry feed	57	.75	
	Cash	111		.75
	100 lbs. oyster shells			
	General farm expense	52	100.00	
	Cash	111		100.00
	Taxes (1944)			
	Wages	59	60.00	
	Cash	111		60.00
	Mr. Webster's wages for January			
	Truck expenses	54	8.12	
	Cash	111		8.12
	Inner tubes for Ford truck (2)			
	Improvements expense	592	125.00	
	Cash	111		125.00
	Bought 500 cedar posts @ 15¢; 10 rolls of wire @ $4.50 per roll; 50 lbs. of staples @ 10¢			
31	Personal	33	375.00	
	Cash	111		375.00
	Bought one $500 War Bond			

d. *Posting the journal entries.* Each of these journal entries is posted to the appropriate ledger accounts. It is not necessary to describe the procedure used, since this has been done in Sec. 1. These entries for January, together with all entries for the year, are shown in the complete set of accounts:

Complete Set of Ledger Accounts

Assets 1

Current Assets 11

Cash 111

1945				
Jan. 1	$500.00	Jan. 30		$4.50
6	41.95	30		6.00
8	24.00	30		62.79
13	45.32	30		96.00
13	587.20	30		14.50
20	90.20	30		.75
26	48.00	30		100.00
26	51.36	30		60.00
27	64.24	30		8.12
Feb.	210.75	30		125.00
Mar.	302.90	30		375.00
Apr.	315.60	Feb.		276.40
May	216.50	Mar.		514.60
June	195.00	Apr.		77.33
July	199.80	May		560.56
Aug.	756.75	June		248.63
Sept.	755.50	July		335.41
Oct.	1,287.90	Aug.		526.70
Nov.	1,567.00	Sept.		483.57
Dec.	1,943.00	Oct.		1,065.07
		Nov.		1,748.56
		Dec.		1,974.76
			Balance	538.72
	9,202.97			9,202.97
1946				
Jan. 1 Balance on hand	538.72			

Feeds, Crops, Supplies Inventory 112

1945			
Jan. 1	777.00	Dec. 31	777.00
1946			
Jan. 1	1,161.00		

Livestock Inventory 113

1945					
Jan. 1		793.00	Dec. 31		793.00
1946					
Jan. 1		814.00			

Fixed Assets 12

Land 121

1945					
Jan. 1		3,405.00			

Buildings and Improvements 122

1945					
Jan. 1		4,690.00	Dec. 31		234.00
			Dec. 31	Balance	4,456.00
		4,690.00			4,690.00
1946					
Jan. 1		4,456.00			

Machinery and Equipment 123

1945					
Jan. 1		934.00	Dec. 30		400.00
			31		29.00
			31	Balance	505.00
		934.00			934.00
1946					
Jan. 1		505.00			

Growing Crops Inventory 124

1945					
Jan. 1		114.00	Dec. 31		114.00
1946					
Jan. 1		103.50			

Liabilities 2

Current Liabilities 21

Notes Payable 211

1945			
Nov. 13	500.00	Jan. 1	173.00
Dec. 30	173.00	Aug. 15	500.00
	673.00		673.00

Accounts Payable 212

Job P. Wyatt and Sons 2121

1945			
Mar.	25.00	Jan. 1	130.00
July	15.00	Feb.	7.90
Aug.	10.00	June	13.43
Sept.	10.00		
Dec.	91.33		
	151.33		151.33

Weil Brothers 2122

1945			
Oct.	441.75	April	441.75

Fixed Liabilities 22

Farm Mortgage 221

1945			
May	160.00	Jan. 1	3,557.00
Nov.	160.00		

Proprietary Interest 3

Investments 31

1945				
Dec. 31	Balance	7,746.22	Jan. 1	7,353.00
			Dec. 31	393.22
		7,746.22		7,746.22

Profit and Loss 32

1945					
Dec. 31	Buildings and improvements	234.00	Dec. 31	Feeds, crops, supplies	384.00
	Machinery and equipment	29.00		Livestock	21.00
	Growing crops	10.50		Tobacco	2,445.20
	Building repairs	183.35		Cotton and cotton seed	854.05
	General farm expense	330.98		Feed and grain crops	1,522.00
	Equipment expense	37.30		Poultry and eggs	2,866.42
	Truck expense	183.10		Dividends, AAA payments, discounts	115.30
	Seed	183.48			
	Feeds, crops, supplies	460.23			
	Poultry feed	1,476.85			
	Poultry supplies	183.56			
	Wages and labor	1,102.40			
	Crop expense	100.00			
	Imp. expense	125.00			
	To Albert Jones personal	3,568.22			
		8,207.97			8,207.97

Personal 33

1945					
Jan.		375.00	Dec. 31		3,568.22
Mar.		250.00			
Oct.		300.00			
Nov.		750.00			
Dec.		1,500.00			
Dec. 3	To Albert Jones Investment	393.22			
		3,568.22			3,568.22

Income 4

Sale of Crops 41

Tobacco 411

1945				
Dec. 31	Loss and gain	2,445.20	Jan. 13	587.20
			Oct.	488.00
			Nov.	630.00
			Dec.	740.00
		2,445.20		2,445.20

Cotton and Cottonseed 412

1945				
Dec. 31	Loss and gain	854.05	Sept.	393.00
			Oct.	461.05
		854.05		854.05

Feed and Grain Crops 413

1945				
Dec. 31	Loss and gain	1,522.00	Jan. 1	24.00
			26	48.00
			Apr.	75.00
			Sept.	100.00
			Nov.	625.00
			Dec.	650.00
		1,522.00		1,522.00

Sale of Livestock and Livestock Products 42

Poultry and Eggs 421

1945							
Dec.	31	Loss and gain	2,866.42	Jan.	6		41.95
					13		45.32
					20		90.20
					26		51.36
					27		64.24
				Feb.			170.35
				Mar.			241.50
				Apr.			240.60
				May			212.00
				June			195.00
				July			199.80
				Aug.			256.75
				Sept.			262.50
				Oct.			338.85
				Nov.			303.00
				Dec.			153.00
			2,866.42				2,866.42

Miscellaneous Income 43

Dividends, AAA Payments, Discounts 431

1945							
Dec.	31	Loss and gain	115.30	Feb.			40.40
				Mar.			61.40
				May			4.50
				Nov.			9.00
			115.30				115.30

Expenses 5

Building Repairs 51

1945							
Jan.			62.79	Dec.	31	Loss and gain	183.35
July			10.84				
Sept.			41.72				
Oct.			8.00				
Nov.			40.00				
Dec.			20.00				
			183.35				183.35

General Farm Expense 52

1945				
Jan. 30	4.50	Dec. 31	Loss and gain	330.98
30	6.00			
30	100.00			
Feb.	4.50			
Mar.	4.50			
Apr.	4.50			
May	108.67			
June	4.50			
July	4.50			
Aug.	12.00			
Sept.	4.50			
Oct.	4.50			
Nov.	63.81			
Dec.	4.50			
	330.98			330.98

Equipment Expense 53

1945				
Feb.	7.90	Dec. 31	Loss and gain	37.30
Sept.	24.50			
Oct.	2.27			
Nov.	2.63			
	37.30			37.30

Truck Expense 54

1945				
Jan.	8.12	Dec. 31	Loss and gain	183.10
Feb.	42.55			
Mar.	12.00			
Apr.	11.25			
May	10.11			
June	13.55			
July	12.67			
Aug.	6.20			
Sept.	39.85			
Oct.	14.55			
Nov.	7.75			
Dec.	4.50			
	183.10			183.10

Seed 55

1945				
Feb.	11.00	Dec. 31	Loss and gain	183.48
Mar.	9.20			
May	38.28			
June	11.00			
Sept.	52.00			
Oct.	12.00			
Nov.	50.00			
	183.48			183.48

Crop Supplies 56

1945				
Feb.	2.05	Dec. 31	Loss and gain	460.23
Apr.	441.75			
June	13.43			
June	1.00			
July	2.00			
	460.23			460.23

Poultry Feed 57

1945				
Jan. 30	96.00	Dec. 31	Loss and gain	1,476.85
30	.75			
Feb.	98.80			
Mar.	136.50			
May	168.50			
June	153.50			
July	152.00			
Aug.	288.00			
Sept.	127.00			
Oct.	82.00			
Nov.	85.00			
Dec.	88.80			
	1,476.85			1,476.85

Poultry Supplies 58

1945				
Jan.	14.50	Dec. 31	Loss and gain	183.56
Feb.	57.50			
Mar.	17.40			
Apr.	1.58			
May	15.00			
June	5.08			
July	16.00			
Aug.	2.50			
Sept.	19.00			
Oct.	35.00			
	183.56			183.56

Wages and Labor 59

1945				
Jan.	60.00	Dec. 31	Loss and gain	1,102.40
Feb.	60.00			
Mar.	60.00			
Apr.	60.00			
May	60.00			
June	60.00			
July	122.40			
Aug.	208.00			
Sept.	150.00			
Oct.	80.00			
Nov.	92.00			
Dec.	90.00			
	1,102.40			1,102.40

Crop Expense 591

1945				
Sept.	15.00	Dec. 31	Loss and gain	100.00
Oct.	85.00			
	100.00			100.00

Improvements Expense 592

1945				
Jan. 30	125.00	Dec. 31	Loss and gain	125.00

Depreciation 593

1945					
Dec. 31		234.00	Dec. 31	Loss and gain	263.00
		29.00			
		263.00			263.00

Feeds, Crops, and Supplies 594

1945					
Dec. 31	First inventory	777.00	Dec. 31	Second inventory	1,161.00
31	Loss and Gain	384.00			
		1,161.00			1,161.00

Livestock 595

1945					
Dec. 31	First Inventory	793.00	Dec. 31	Second inventory	814.00
31	Loss and Gain	21.00			
		814.00			814.00

Growing Crops 596

1945					
Dec. 31	First inventory	114.00	Dec. 31	Second inventory	103.50
			31	Loss and Gain	10.50
		114.00			114.00

e. *Trial balance.* At any given time the ledger accounts should be in balance, *i.e.,* the value of the total debit items should be equal to the total credit items. The reason for this is that each item has a debit and a credit entry (see page 400). For the purpose of testing this theory of equal debit and credit values and to show how a trial balance statement should be constructed, items posted in the Ledger for January will be used:

Trial Balance, January 31, 1945

	Dr.	*Cr.*
Cash	$ 1,452.27	$852.66
Feeds, crops, and supplies inventory	777.00	
Livestock inventory	793.00	
Land	3,405.00	
Buildings and improvements	4,690.00	
Machinery and equipment	934.00	
Growing crops inventory	114.00	
Notes payable		173.00
Job P. Wyatt and Sons		130.00
Farm mortgage		3,557.00
Albert Jones—Investment		7,353.00
Personal	375.00	
Tobacco		587.20
Feed and grain crops		72.00
Poultry and eggs		293.07
Building repairs	62.79	
General farm expense	110.50	
Truck expense	8.12	
Poultry feed	96.75	
Poultry supplies	14.50	
Wages and labor	60.00	
Improvements expense	125.00	
	$13,017.93	$13,017.93

It is usually desirable to prepare a trial balance at least once a month. This procedure is designed to discover any mistakes in posting. The trial balance, however, must not be considered as an absolute test of the correctness of entries in the Ledger. There are several errors which are not discoverable by this method. For example, an entry may be made on the correct side of the Ledger but to the wrong account. In some cases an error may be attributed to the failure to record the item. In such cases the error would not be indicated by the trial balance, since both the debit and credit entries were omitted. In such an event the recorded debits and credits would balance. Another error not revealed by the trial balance is an error made in the original entry. Once such an error is made, it is difficult to discover and correct. Errors in posting may be attributed principally to one of the following reasons: [4]

1. The amount recorded is incorrect, *e.g.*, the number $170 in one account may be recorded as $107 in another.
2. Failure to post one of the entries, *e.g.*, the debit entry may be made but the credit entry omitted.
3. Both debit and credit entries posted to either debit or credit side of the Ledger.

f. *Closing the ledger accounts.* At the end of the year, or any other designated accounting period, the ledger accounts should be closed. This procedure is necessary to determine the condition of the business as a whole. Before the accounts can be closed, however, all current entries must be checked and any not already on the books should be posted to the appropriate ledger accounts.

In addition to posting any current entries which have been overlooked, it is essential to journalize and post some *adjusting entries.* The purpose of these is to place on the books the assets available at the year's end and liabilities which have not been disposed of. A preclosing trial balance should then be made, after which the *closing entries* can be made. Closing entries consist of the net balances of the productive and service accounts which are carried to the loss and gain account. (See Fig. 55.) The net balance of the *loss and gain* account is then carried to the investment account which when closed shows the *net capital.*

For this set of accounts the adjusting and closing entries, as they appear in the Journal, are as follows:

Adjusting Journal Entries

Date	Explanation	F	Dr.	Cr.
1945				
Dec. 31	Feeds, crops, and supplies	594	777.00	
	Feeds, crops, and supplies inventory	112		777.00
	Livestock	595	793.00	
	Livestock inventory	113		793.00

---

[4] See McMurry and McNall, *Farm Accounting,* Chapter 11, for a discussion of this subject.

Adjusting Journal Entries (Cont.)

Date	Explanation	F	Dr.	Cr.
1945				
Dec. 31	Growing crops	596	114.00	
	Growing crops inventory	124		114.00
	To close the old balance of inventory accounts into the respective adjustment accounts			
	Feeds, crops, supplies inventory	112	1,161.00	
	Feeds, crops, and supplies	594		1,161.00
	Livestock inventory	113	814.00	
	Livestock	595		814.00
	Growing crops inventory	124	103.50	
	Growing crops	596		103.50
	To record inventories at the end of the year			
	Depreciation	593	234.00	
	Buildings and improvements	122		234.00
	Depreciation	593	29.00	
	Machinery and equipment	123		29.00
	To record depreciation for the year			

Closing Journal Entries

Date	Explanation	F	Dr.	Cr.
1945				
Dec. 31	Tobacco	411	$2,445.20	
	Cotton and cottonseed	412	854.05	
	Feed and grain crops	413	1,522.00	
	Poultry and eggs	421	2,866.42	
	Dividends, AAA payments, discounts	431	115.30	
	Feeds, crops, supplies	594	384.00	
	Livestock	595	21.00	
	Loss and Gain	32		$8,207.97
	Loss and Gain	32	4,639.75	
	Building repairs	51		183.35
	General farm expense	52		330.98
	Equipment expense	53		37.30
	Truck expense	54		183.10
	Seed	55		183.48
	Crop supplies	56		460.23
	Poultry feed	57		1,476.85
	Poultry supplies	58		183.56
	Wages and labor	59		1,102.40
	Crop expense	591		100.00
	Improvements expense	592		125.00
	Depreciation	593		263.00
	Growing crops	596		10.50
	Loss and Gain	32	3,568.22	
	Personal	33		3,568.22
	Personal	33	393.22	
	Albert Jones—Investment	31		393.22

Pre-Closing Trial Balance, December 31, 1945

	Dr.	*Cr.*
Cash	$9,202.97	$8,664.25
Feeds, crops, supplies	777.00	
Livestock	793.00	
Land	3,405.00	
Buildings and improvements	4,690.00	
Machinery and equipment	934.00	400.00
Growing crops	114.00	
Notes payable	673.00	673.00
Accounts payable	593.08	593.08
Farm mortgage	320.00	3,557.00
Net worth		7,353.00
Personal	3,175.00	
Tobacco		854.05
Grains and feed crops		1,522.00
Poultry and eggs		2,866.42
Dividends, AAA payments, discounts		115.30
Building repairs	183.35	
General farm expense	330.98	
Equipment expense	37.30	
Truck expense	183.10	
Seed	183.48	
Feeds, crops, supplies	460.23	
Poultry feed	1,476.85	
Poultry supplies	183.56	
Wages and labor	1,102.40	
Crop expense	100.00	
Improvements expense	125.00	
	$29,043.30	$29,043.30

3. Keeping Simple Farm Accounts by Columnar Method

It is not at all necessary to keep farm accounts in the manner used in Section 2. The same results may be obtained by using what is called the *Columnar Method.*[5] When this method is used, the *current cash transactions* are recorded directly on a specially prepared form. The form is so ruled that there is a column for each important account. Usually this form is divided into two parts, one of which is to be used to record receipts, the other to record expenses. A space is provided for a description of each transaction. The totals of these columns at the end of each month are posted to the appropriate ledger accounts.

---

[5] This is simply a modified form of the General Journal.

The opening, adjusting, closing, and noncash entries are not recorded on this form. The omission of these is to reduce the columns to a minimum and not because they could not be included. Ledger accounts which are not provided for in the form may be included in the conventional ledger.

To facilitate comparison between this and the method used in Section 2, the same data will be used. For the first month the current transactions will be recorded just as they occur, after which only monthly totals will be used. The columns will carry the same numbers as the ledger accounts. For example, the columns used to record cash receipts and cash disbursements will be numbered 111. The columns also will be labeled *Dr.* or *Cr.* to indicate the debit or credit side of the ledger account.

a. *Recording the transactions.* The transactions as they occur may be recorded directly on this form. For example, on January 6 there were sold 95⅓ dozen eggs at 44 cents per dozen. This is a cash receipt of $41.95 which is placed in the column labeled *Cash* and also in the column labeled *Poultry and Eggs.* Since cash is received, this item would appear on the debit side of the ledger account, for this reason the column is marked *Dr.* and the Poultry and Egg column is marked *Cr.* In this fashion there is a debit and a credit entry for each transaction, as required in the conventional method.

Some transactions do not involve the immediate receipt or expenditure of cash. For example, the 95⅓ dozen eggs could have been sold on account. In all cases of this kind the entry is made in the General Journal. When the cash is actually received for the products sold, the sum is entered in the Cash Column (Dr.) and the Noncash Transaction or Charge Accounts Column on the expense side of the form is credited. The credit transactions are recorded in the usual manner—through the Journal and posted to specific ledger accounts.

To illustrate the procedure, let it be supposed that the 95⅓ dozen eggs were sold on account to P.W. This transaction would appear in the General Journal as follows:

Transaction	Dr.	Cr.
P.W.	$41.95	
Poultry		$41.95
Sold on account 95⅓ dozen eggs to P.W.		

When P.W. paid for these eggs the Journal entry would be:

Transaction	Dr.	Cr.
Cash	$41.95	
P.W.		$41.95
P.W. paid for 95⅓ dozen eggs bought January 6.		

Since all cash transactions are recorded directly to the Columnar Cash Journal, this last transaction would not be recorded in the General Journal but carried directly to the Columnar Cash Journal. The cash column would be debited with $41.95 and the charge account column would be credited. Later, when the ledger accounts were being closed, this credit entry would be carried to P.W. ledger account and all of the cash (total of Dr. and Cr. columns) would be carried to the cash account in the Ledger.

Where purchases are made on account, the transactions will be entered in the General Journal, and when the accounts are paid the transaction will be recorded in the Columnar Cash Journal. In such cases the amount of cash paid out will be entered in the cash Cr. column and the charge account column will be debited.

b. *Mixed Columnar Journal.* It is not necessary to enter the noncash transactions in the General Journal if specific columns are provided for each account in the Columnar Journal. This may be illustrated by assuming that P.W. usually buys eggs on account. If so, Dr. and Cr. columns can be provided and each transaction can be recorded in the usual manner, *i.e.*, the amount of the transaction can be entered in the Poultry column (Cr.) and also in P.W.'s Dr. column. When P.W. pays for the eggs, the entry is made in the Cash Dr. column and also in P.W.'s

Columnar Journal: *Receipts*

Cash Receipts 111	Date	Details of Transaction	Tobacco 411	Cotton and Cottonseed 412	Feed and Grain Crops 413	Eggs and Poultry 421	Miscellaneous Receipts 431
Dr.	Jan. 6		Cr.	Cr.	Cr.	Cr.	Cr.
41.95		95⅓ doz. eggs @ 44¢				41.95	
24.00	8	12 bu. sweet potatoes @ $2.00			24.00		
45.32	13	103 doz. eggs @ 44¢				45.32	
587.20	13	1468 lbs. tobacco @ 40¢	587.20				
90.20	20	205 doz. eggs @ 44¢				90.20	
48.00	26	24 bu. sweet potatoes @ $2.00			48.00		
51.36	26	203 # poultry @ 25.3¢				51.36	
64.24	27	146 doz. eggs @ 44¢				64.24	
210.75	Feb.					170.35	40.40
302.90	March					241.50	61.40
315.60	April				75.00	240.60	
216.50	May					212.00	4.50
195.00	June					195.00	
199.80	July					199.80	
756.75	Aug.					256.75	500.00
755.50	Sept.			393.00	100.00	262.50	
1287.90	Oct.		488.00	461.05		338.85	
1567.00	Nov.		630.00		625.00	303.00	9.00
1943.00	Dec.		740.00		650.00	153.00	400.00
8702.97	Total		2,445.20	854.05	1,522.00	2,866.42	1,015.30

Columnar Journal: *Expenditures*

Charge Account 212	Cash Spent 111	Date	Details of Transaction	Line No.	Building Repairs 51	General Farm Expense 52	Equipment Expense 53	Truck Expense 54	Seed 55
Cr.	Cr.				Dr.	Dr.	Dr.	Dr.	Dr.
	4.50	Jan. 30	Electricity and telephone	1		4.50			
	6.00		Legal service	2		6.00			
	62.79		8102 bd. ft. lumber	3	62.79				
	96.00		2400 # laying mash	4					
	14.50		1000 egg cartons	5					
	.75		100 # oyster shells	6					
	100.00		1944 taxes	7		100.00			
	60.00		Mr. W.'s wages	8					
	8.12		Inner tubes for truck (2)	9				8.12	
	125.00		Fence posts and wire	10					
	375.00		$500.00 war bond	11					
7.90	276.40	Feb.		12		4.50	7.90	42.55	11.00
	514.60	March		13		4.50		12.00	9.20
441.75	77.33	April		14		4.50		11.25	
	560.56	May		15		108.67		10.11	38.28
13.43	248.63	June		16		4.50		13.55	11.00
	335.41	July		17	10.84	4.50		12.67	
	526.70	Aug.		18		12.00		6.20	
	483.57	Sept.		19	41.72	4.50	24.50	39.85	52.00
	1,065.07	Oct.		20	8.00	4.50	2.27	14.55	12.00
	1,748.56	Nov.		21	40.00	63.81		7.75	50.00
	1,974.76	Dec.		22	20.00	4.50	2.63	4.50	
463.08	8,664.25	Total			183.35	330.98	37.30	183.10	183.48

Columnar Journal: *Expenditures (Cont'd)*

Line No.	Feed, Crops, Supplies 56	Poultry Feed 57	Poultry Supplies 58	Wages and Labor 59	Crop Expense 591	Improvements Expense 592	Notes Payable 211	Accounts Payable 212	Farm Mortgage 221	Miscellaneous Expense (Personal) 33
	Dr.	Dr.	Dr.	Dr.	Dr.	Dr.	Dr.	Dr.	Dr.	Dr.
1										
2										
3										
4		96.00								
5			14.50							
6		.75								
7										
8				60.00						
9										
10						125.00				
11										375.00
12	2.05	98.80	57.50	60.00						250.00
13		136.50	17.40	60.00				25.00		
14	441.75		1.58	60.00						
15		168.50	15.00	60.00					160.00	
16	14.43	153.50	5.08	60.00						
17	2.00	152 00	16.00	122.40				15.00		
18		288.00	2.50	208.00				10.00		
19		127.00	19.00	150.00	15.00			10.00		
20		82.00	35.00	80.00	85.00			441.75		300.00
21		85.00		92.00			500.00		160.00	750.00
22		88.80		90.00			173.00	91.33		1,500.00
	460.23	1,476.85	183.56	1,102.40	100.00	125.00	673.00	593.08	320.00	3,175.00

Cr. column. At the end of the accounting period the totals of each column can be carried to the appropriate ledger account.

4. An Analysis of the Results

It is quite possible that an inquisitive person who is not familiar with accounting might very well raise the question as to the meaning of the ledger accounts. As they now stand, they obviously contain all the financial data relating to the operation of this farm. But in order to make these facts mean something, they must be analyzed. This may be done in several ways. The conventional method of analysis is to prepare an operating statement and a financial statement. The operating statement is prepared from the information on sales and expenses and shows the *net profit* for the year. The net profit, as shown by the operating statement, is identical to the balance of the loss and gain account. But in the case of the operating statement the sources of income and the origin of the cost are shown.

Operating Statement, January 1 to December 31, 1945

Income:		
Tobacco sales	$2,445.20	
Cotton and cottonseed sales	854.05	
Feed and grain crops sales	1,522.00	
Poultry and egg sales	2,866.42	
Miscellaneous income	115.30	
Increase in inventories	405.00	$8,207.97
Expenses:		
Building repairs	183.35	
General farm expense	330.98	
Equipment expense	37.30	
Truck expense	183.10	
Seed	183.48	
Feeds, crops, supplies	460.23	
Poultry feed	1,476.85	
Poultry supplies	183.56	
Wages and labor	1,102.40	
Crop expense	100.00	
Improvements expense	125.00	
Decrease in inventories	273.50	$4,639.75
Net profit for year from farming		$3,568.22

In short, the operating statement is made up from the information in the loss and gain account, which is a summary of the various operating and service accounts of the Ledger. It is quite obvious that this statement is more revealing than a perusal of the ledger accounts.

But our inquisitor might insist on knowing what in the meantime has happened to the assets and liabilities of the farm. At the beginning of this discussion it was said that the starting point in keeping accounts was an inventory and a financial statement. It can be said that this is also the end of any set of accounts. The operator sets out with certain assets and liabilities to which have been attached specific values. During the period of operation these assets and liabilities have undergone changes. For example, the cash has been augmented by the sale of crops or livestock products, or has been diminished by expenditures of various kinds. The equipment may have been augmented by the purchase of new machinery, or diminished by use. Again, the liabilities may have been reduced by the payment of specific debts, or increased by new obligations, such as buying fertilizer on account. It is these things which make the financial statement of great significance. It means essentially that the condition of the business at any given time, as compared to the condition at another time, can be used to determine the net gain or net loss for the period. And this is the same fact obtained from the operating statement.

If there is any doubt as to how this occurs, it may be removed by examining the financial statements of this farm at the beginning and end of the year. The first of these statements has been presented on page 404; the second is as follows:

Financial Statement, December 31, 1945

Assets			
Cash on hand		$538.72	
Land		3,405.00	
Buildings		4,456.00	
Livestock		814.00	
Equipment		505.00	
Feeds, crops, and supplies		1,161.00	
Growing crops		103.50	
(1) Total assets			$10,983.22
Liabilities			
Mortgage		3,237.00	
(2) Total liabilities			3,237.00
Proprietorship			
Mr. Jones's capital January 1, 1945 (p. 404)		7,353.00	
Plus profits for the year	$3,568.22		
Less personal withdrawals (p. 410)	3,175.00	393.22	
(3) Net worth (1 minus 2)			7,746.22

Another question may be asked: "If the same results can be obtained by the financial statements, why keep farm accounts?" Although it is true that the results as to *condition* and *progress* of the business, as obtained from the financial statements, show whether or not the business is solvent and whether or not, as a result of the operations of the farm, a net gain has been made or a net loss incurred, there is no evidence from these statements as to where or how such gains were made or how the losses were incurred. It is one of the chief purposes of accounting to determine these facts and to assist in analyzing the internal data so that the operation of the business can be made more effective.

Questions

1. What is meant by accounting? bookkeeping?

2. Name the major classes into which accounts may be divided, and indicate the nature and function of each class.

3. What is meant by "books of accounts," and what is the function of each book?

4. Define: (a) debit, (b) credit, (c) asset, and (d) liability.

5. Describe and give examples of the Dewey Decimal System of numbering farm accounts.

6. Describe briefly the procedure in keeping a set of simple farm accounts.

7. How does the Columnar Method of keeping farm accounts differ from the Conventional Method?

8. Name some of the results which can be obtained from a set of farm accounts.

References

Hopkins, John A., *Farm Records.* Ames: The Iowa State College Press, 1942.
McMurry, Karl F., and McNall, Preston E., *Farm Accounting.* Chicago and New York: A. W. Shaw Company, 1926.
Mitchell, Donald R., *Farm Accounting.* New York: McGraw-Hill Book Company, 1941.
Scovill, H. T., *Farm Accounting.* New York: D. Appleton and Company, 1931.

CHAPTER XXIV

The Share Rental Contract

THE selection of a farm to be rented is governed by the same general principles as are set forth in the discussion on selecting a farm for purchase. There are, however, a few exceptions. The renter need not be as concerned as a prospective owner with the size and location of the farm or with the natural conditions of the land. The tenant's interest lies principally in selecting a farm that is in good physical condition, that is approximately large enough to suit the tenant's present managerial capacity, that is conveniently located with respect to markets and schools, and that is in a neighborhood which provides such social amenities as are consistent with the tenant's social status. Mistakes made by the tenant in any of these particulars are not serious, because his contract is for a limited period and he may move to some other locality if conditions are not such as will yield the maximum net returns. If, however, the tenant is planning to purchase at some later time, then all of the factors which have been stressed in Chapter XVI should be given consideration.

1. Conventional Types of Rental Contracts

The rental contract is probably as important to the tenant as the character of the farm to be rented. A tenant is seldom if ever compelled to rent a given farm, but most contracts in use are the result of custom, and tend, in the main, to favor the landlord. The tenant, therefore, should be cautious as to both the type and the provision of the contract. Let us consider first the conventional types.

The type of contract is usually designated by the manner in which the *owner* is paid for the use of the factors of production which he contributes. The two common types in the United States are *cash-rental* and *share-rental* contracts. The first indicates that the owner is paid in cash or currency, and the second, that he is paid with a share of the produce grown. There is also a combination of these two—namely, *share-cash* rental. Under the classification of share rental are found a number of variations: two-thirds, three-fifths, one-half, one-third, and one-fourth, depending on the share of the produce paid the landowner.

a. **Cash rental.** Ordinarily under cash rental the owner furnishes only land and buildings, and for their use is paid by the tenant a cash payment, or rent. This type of rental contract is commonly prevalent under conditions of absentee ownership or nonfarmer ownership. The tenant usually is an experienced operator and has his own workstock, equipment, and working capital. Modifications of the system occur when payment in cash is made for the use of pasture land or other land and when share rental is paid for part of the crop land.

b. **Share rental.** (1) *The two-thirds share.* Under this system the owner usually furnishes everything except labor and, as the name implies, receives two-thirds share of the produce. Some variations occur as to what the tenant furnishes; for example, the tenant may, in addition to labor, furnish also one third of the cash expenses and in some cases one half the livestock and operating equipment.

(2) *One-half share.* In the Cotton Belt the one-half-share rental is characteristic of the cropper system. The owner furnishes the land and buildings, all workstock and operating equipment, one half cash expenses for fertilizer, ginning, seed, and the like, and practically all the managerial ability. This leaves the tenant only labor and half the cash expenses. Fertilizer and labor are normally among the largest cost items. The owner in the Wheat Belt usually furnishes land and buildings plus the seed grain. Labor requirements being low, the tenant may be required to furnish

in addition to labor some power and machinery. In the Corn Belt, particularly where the land is exceptionally fertile, the owner furnishes only land and buildings. In some instances, hay and pasture land is rented for cash; in other instances, it may be given free. Where livestock farming prevails, a contract known as land-and-stock share is common. The owner under this form of lease furnishes land, buildings, one-half the livestock, and one-half the cash expenses. The tenant furnishes labor, power, operating equipment, one-half the productive livestock, and one-half the cash expenses. It is assumed that land and buildings will about balance labor, workstock, and operating equipment. All other factors are contributed equally. Minor variations are numerous in this system as well as in other systems.

(3) *Two-fifths share.* This type of contract is most common on fertile land in the North Central States. The owner, as a rule, furnishes only land and buildings, and frequently, only land. Other than dictating the crops to be grown, the landowner leaves the management to the tenant.

(4) *One-third share.* This contract is practically the same as the two-fifths share in regard to what the owner furnishes, the difference being due to the quality of the land. This form of contract is also most common in the North Central States. In the Cotton Belt the owner usually gets one third of the feed crops.

(5) *One-fourth share.* The one-fourth-share-rental contract is common on unproductive lands in the North and in all parts of the South. In the North and Northwest the owner furnishes land and buildings. In the South the owner furnishes land, buildings, and one fourth of the ginning and fertilizer expenses. The kind and amount of enterprises to be embodied in the program are usually controlled by the owner. The high labor requirements of cotton form the basis for this division of receipts. On the same farms where one fourth the cotton is given the owner, one

third of the feed crops go to him, since labor requirements for them are not very great.

2. Factors Governing Type of Rental Contracts

Generally speaking, there are three factors influencing the division of receipts between the landlord and the tenant. The first is the *amount* of the factors furnished by each party. If the prospective tenant is young, inexperienced, and has little or no capital, he will not be able to furnish a very large percentage of the factors of production. He will need to rely on the owner for advice, workstock, and tools, as well as for land and buildings. In such a case, the owner will get a large percentage of the receipts. Of course, in other instances, the tenant may be experienced and may have accumulated workstock and productive livestock. In such cases he may require only land and buildings of the owner. Between these two extremes are found numerous variations. As both owners and tenants, of course, desire to use all their resources, the matching of resources is often a complicated problem.

The second thing affecting the type of rental contract is the *quality* of the factors of production furnished by each party. The contribution of land is in many sections assumed to be equal to the contribution of labor. But in practice this theory is subject to modification on poor or on very rich land, or for crops with high or low labor requirements. The rule is that the poorer the land, the smaller the landlord's share. In the South, one system of tenure gives the owner only one fourth of the cotton, but one third of the corn. This is because cotton requires more labor than corn and the tenant has to furnish all labor.

The third factor is the *relative bargaining power* of the tenant and the landowner. Because he may have a desirable farm or because farms are scarce relative to demand, the owner may be able to "drive a hard bargain with the tenant." Under opposite conditions the tenant may become the "driver." Under conditions of free competition a scarcity of lands will be reflected in higher land prices, and the contract rental will tend to be higher. Similarly, a scarcity of labor will be reflected in a higher wage rate and relatively low rents.

3. The Making of an Equitable Contract

The conventional division of production and the contribution of each party to the contract are shown in Table 83. The landlord under the one-third contract, for example, gets one third of the income and supplies all of the land and buildings, pays the taxes on the property which he owns, pays one third of the cash expenses, and supplies the material for repairs on buildings and fences. The tenant, on the other hand, receives two thirds of the income, furnishes all of the machinery and tools, workstock and productive livestock, all labor whether hired or family labor, including board, two thirds of the cash expenses, pays taxes and insurance on property which he owns, pays all veterinary fees and medicines, supplies the labor for making repairs on buildings and fences, repairs all machinery, and looks after such things as horseshoeing. Are contracts based on such conventional divisions of the income equitable? Although this question is easily raised, it is by no means easily answered, because contracts as usually presented are rather confusing, and it is not always possible to determine whether or not they are equitable. In general, it may be said that the division of the receipts does show that the share or proportion of the production has been based on the contribution made by each party. Or, to state it in another way, each party to the contract is rewarded in proportion to the share of the factors which each contributes. In a rough way, no doubt, this holds true for all contracts, but only roughly.

Can a contract be so drawn that each party will receive that part of the income which in justice belongs to him, or which bears a close relationship to the contribution which he makes to the farm output? This can be done if the

TABLE 83

PORTIONS FURNISHED BY LANDLORD AND TENANT AND SHARE OF INCOME IN THE SHARE RENT TYPE OF LEASE [a]

Capital Furnished, Income, and Expenses	*One-Third Share*		*One-Half Share*		*Two-Thirds Share*	
	Landlord	*Tenant*	*Landlord*	*Tenant*	*Landlord*	*Tenant*
1. Income share	⅓	⅔	½	½	⅔	⅓
2. Land and buildings	All	...	All	...	All	...
3. Machinery and tools	...	All	...	All	All	...
4. Work horses	...	All	...	All	All	...
5. Productive livestock	..	All	½	½	All	...
6. Labor, including board for hired labor	...	All	...	All	...	All
7. Cash expenses as feed, seed, twine, spray material, machine hire, such as threshing, etc. [b]	⅓	⅔	½	½	⅔	⅓
8. Taxes and insurance	On own property	On own property	On own property	On own property	On own property	On own property
9. Veterinary services	...	All	½	½	All	...
10. Repairs:						
Buildings	Material	Minor labor & hauling	Material	Minor labor & hauling	Material	Minor labor & hauling
Fences	"	"	"	"	"	"
Machinery	...	All	...	All	All	...
Horseshoeing	..	All	...	All	All	...

---

[a] "Farm Lease Systems in Michigan," *Circular Bulletin No. 102,* Michigan Agricultural Experiment Station.

[b] These expenses are not fixed and vary between the landlord and tenant, depending on the conditions of the contract. The tenant should bear his share of such items as feed purchased, which are used in increasing the farm income.

tenant and landlord are willing to come to terms on the value of their contributions and to keep throughout the year a record of the farm business.

TABLE 84

LANDLORD'S AND TENANT'S CONTRIBUTIONS OF THE FACTORS OF PRODUCTION [a]

Factor	*Landlord's Claim*	*Tenant's Claim*	*Total*
Land	$5,000	......	$5,000
Buildings	2,000	......	2,000
Workstock	......	$500	500
Productive livestock	......	1,000	1,000
Machinery and tools	.....	500	500
Labor	......	500	500
Cash expenses	500	1,000	1,500
Total	$7,500	$3,500	$11,000

---

[a] These items are all estimated in advance of the actual signing of the contract, and are not subject to change, except as may be provided for in the contract. For example, the cash expenses may not be exactly $1,500, but the contract would specify the nature of the division of such expenses as well as the estimated amount.

The first prerequisite for the development of a sound rental contract is an agreement between the landlord and the tenant as to the value of their respective contributions. Let it be supposed that the data in Table 84 represent the value of a landlord's and a tenant's contribution. In this hypothetical case it is mutually agreed that the value of the land contributed by the landlord is $5,000. In any actual case, the landlord might claim a higher value for the land, which would not be agreed to by the tenant. Hence, there would have to be some adjustment in the claim. The same would hold true in regard to the tenant's claim for such things as workstock and productive livestock. According to Table 84, it is assumed that both the landlord and the tenant have agreed on the value of all the factors that will be used during the year.

The share of the cash expenses to be borne by each party should be definitely agreed upon and the approximate amount of these expenses stated. Perhaps, in most cases, it would be advisable to set definite limits to the expenses. The amounts in this assumed case are $500 for the landlord and $1,000 for the tenant. Finally, some estimate must also be made and some agreement must be reached as to the value of the tenant's labor. In this case it is assumed that the labor of the tenant is worth (according to current wages) $500.[1]

The second prerequisite in preparing the contract is an agreement between the tenant and the landlord on a reasonable return on their investments. In this case, it is assumed that they have mutually agreed that the landlord should have 4 per cent on the $5,000 invested in land, and 5 per cent on the amount invested in buildings and that the tenant should have 5 per cent on his $2,000 invested in workstock, livestock, machinery, and tools.

Following the agreement as to the contribution of each party and the rate of return which each should receive, it is necessary to provide for the keeping of such records as are necessary to the compiling of an income statement at the end of the year. Suppose that records have been kept by the tenant and landlord from which an income statement similar to that presented in Table 85 could be prepared. In this case, the net farm income or the difference between the total receipts and total cash expenses, exclusive of such things as depreciation and taxes, is $2,000. Taxes and depreciation may be omitted, because usually they will be paid by the parties according to the value of their respective holdings. The value of the farm production used by the landlord and tenant is entered as a receipt, because it is assumed that such products could be sold on the market if not used by either of the two parties.

---

[1] In some cases, when the landlord assists in managing the farm, an estimate of the value of management will need to be made.

TABLE 85

Farm Income Statement

Income		*Expenses*	
Crop sales	$2,500	Wages paid	$500
Livestock product sales	400	Feed bought	300
Livestock sales	100	Fertilizer bought	300
Woodlot product sales	50	Livestock bought	100
Miscellaneous cash sales	100	Machinery bought	50
Value of farm products used by landlord and tenant[a]	350	Repairs	50
		Other cash expenses	200
		Total expenses	$1,500
		Net farm income	2,000
Total income	$3,500		$3,500

[a] The value of farm products used by each party was treated as sales and credited to the farm and is exclusive of the value of any products obtained from the farm garden.

The question arises as to how this total net income should be divided. Should the landlord receive one-third, one-half, or some other fraction of this net return? Table 86 illustrates how this question may be answered. The landlord's claim is $800, and the tenant's claim is $1,600.[2] The sum of these two claims exceeds the actual net income by $400.

TABLE 86

Distribution of Net Income According to Contribution of Each Party to the Contract

Landlord's Claim		*Tenant's Claim*	
Land, 4% on $5,000	$200	Capital, 5% on $2,000	$ 100
Buildings, 5% on $2,000	100	Labor	500
Cash expenses, ⅓ of $1,500	500	Cash expenses, ⅔ of $1,500	1,000
Total	$800	Total	$1,600

Total actual net income		$2,000
Landlord's claim	$ 800	
Tenant's claim	1,600	2,400
Excess of claims over actual income		$ 400

---

[2] Based on their contribution.

Landlord's claims	$800.00	Tenant's claims	$1,600.00
Less share of excess	133.33	Less share of excess	266.67
Actual share	$666.67	Actual share	$1,333.33
Share of net income	⅓	Share of net income	⅔

How shall this excess of claims over actual income be distributed between the two parties—according to the contribution of each? If so, then from the landlord's claim, one third of this excess of claims over actual receipts should be deducted, and from the tenant's claim two thirds. If this plan is followed, the actual share received by the landlord is $666.67, and the actual share of the tenant is $1,333.33. In short, the arrangement between the landlord and the tenant is a bona fide one-third-share contract.

Although this arrangement is in fact a one-third contract, it would not have been so if the land had been either more or less valuable. Suppose, for example, the land were worth $2,500 instead of $5,000, then the landlord's claim to return on land would be $100 instead of $200, which would make the total claim of the landlord $700 instead of $800. Obviously, the producing power of the land affects the net income. Assuming that this effect was equal to $500, then the net income would be $1,500 instead of $2,000. It would probably be true also that the expenses would be somewhat less, although the division of the expenses might not in fact be changed. Let it be assumed that the cash expenses would be $1,200 instead of $1,500, which would make the contribution of the landlord, insofar as cash expenses were concerned, $400, and that of the tenant $800. The claim of the two parties would be, under these assumptions, $600 for the landlord and $1,400 for the tenant, or $2,000 in all, which is $500 in excess of the actual net income. If this $500 excessive claim is distributed according to the contributions of each, then from the landlord's claim $150 is subtracted, and from the tenant's claim $350, making the actual share of the landlord $450 and the tenant's share

$1,050. The contract, according to these assumptions, is not strictly one third but three tenths. To make these last remarks clear, the calculations are given below.

Total actual net income		$1,500
Landlord's claim	$ 600	
Tenant's claim	1,400	2,000
Excess of claims over actual income		$ 500

Landlord's claim	$600	Tenant's claim	$1,400
Less share of excess	150	Less share of excess	350
Actual share	$450	Actual share	$1,050
Share of net income	3/10	Share of net income	7/10

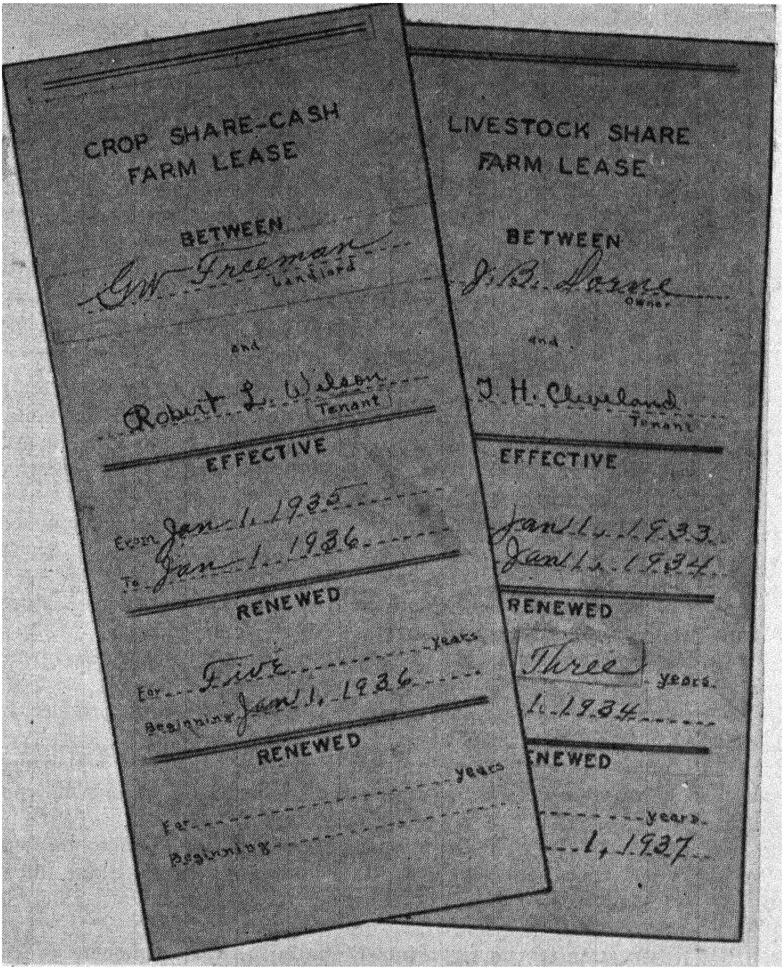
The chief advantages of this method of determining the basis of a contract are flexibility and fairness. By flexibility is meant that the plan may be applied to any conceivable combination of the contributions of the landlord and the tenant. Obviously, also, it provides for any change in the contributions of either party made during the year. For example, if the landlord should increase his investments in the business during the year, he has logically a claim for a larger share of the net income. Likewise, if the tenant's contributions should be increased relative to those of the landlord, then he has a justifiable claim for a larger part of the net returns. In short, this method provides for a division of the net income according to the contributions of each party.

4. The Nature and Preparation of a Written Lease

When the contributions of each party to the farm business and the division of receipts have been agreed upon, a formal written lease should be prepared and signed by each party in the presence of a notary public. The preparation of such a lease is a formidable task. From a legal standpoint the following things must be included:[3] (a) An accurate description of the property under lease; (b) a statement with respect to the term or period for which the contract is in force; (c) an agreement with respect to the division of the income, products, or rental to be paid; (d) the time and place at which such division of the crop or payment is to be

---

[3] Case, H. C. M., and Ackerman, Joseph, "Farm Leases for Illinois," *Circular 474,* University of Illinois, June, 1937.



CROP SHARE-CASH FARM LEASE

BETWEEN

G.W. Freeman
Landlord

and

Robert L. Wilson
Tenant

EFFECTIVE

From Jan. 1, 1935
To Jan. 1, 1936

RENEWED

For Five years
Beginning Jan 1, 1936

RENEWED

For years
Beginning

LIVESTOCK SHARE FARM LEASE

BETWEEN

J. B. [illegible]
Owner

and

J. H. Cleveland
Tenant

EFFECTIVE

Jan. 1, 1933
Jan. 1, 1934

RENEWED

Three years
1, 1934

NEWED

years
1, 1937

Adapted from Cir. 474, Univ. of Ill., Agr. Exp. Sta.

Fig. 56. A rental contract is an instrument which should be drawn with close attention to details.

made; and (e) the signature of the parties to the contract duly witnessed and signed in the presence of a notary public.

The separate provisions which might be included in a written lease are indeed quite numerous. These provisions have been stated by Gray and Turner as follows: [4]

I. General Details

1. Date lease is made.
2. Names and formal designations of landlord and tenant.
3. Number of years lease is to run and dates of beginning and ending.
4. Statement of manner by which the lease is to be terminated or renewed.
5. Brief description of the real estate leased, including name of farm, boundaries, and location with respect to state, county, township, and section.
6. Description of other property included with the real estate in the lease.

II. Reservations

1. Right of entry by the landlord for purpose of inspecting buildings and other improvements, crops, and livestock; for making repairs and improvements; for work in connection with crops of the following harvest; and for other purposes.
2. Reservation by the landlord of parts of buildings, granary space, corn cribs, mow space, and any other portion of the real estate the use of which it is agreed he shall reserve.
3. Reservations and restrictions with respect to the use of pasture, fruit, woods, timber, sand pits, gravel beds, fish, and game.
4. Reservation of the right to decide upon or to direct farming operations.
5. Reservation of the right to buy or sell livestock, crops, produce, or supplies for farm use.
6. Limitations on the kind, amount, or value of property which may be bought or sold without informing the landlord and getting his consent.
7. Designation of a bank in which undivided funds are to be kept or deposited, with agreement as to the disposition or use of these funds.
8. On share-rented farms, a statement denying, acknowledging, or limiting partnership relation.
9. Reservation of the right to sell the farm, with statement of adjustments to be made in the case of sale.

---

[4] Gray, L. C., and Turner, Howard A., "The Farm Lease Contract," *Farmers' Bulletin 1164,* U. S. Department of Agriculture, April, 1930.

III. Assurances and Guaranties by the Tenant

1. To operate the farm in a good and farmerlike manner.
2. Not to sublet the farm.
3. To occupy the farm continuously throughout the lease period.
4. Not to attempt to operate outside land in addition; not to thresh for outsiders as a business nor to give preference to any other work over the operation of the farm.
5. To work for the landlord if requested, at specified rates, when not engaged in work on the farm.
6. To commit no waste or damage, and to suffer none to be committed; to protect and care for the buildings, fences, trees, and other property.
7. To make inventories at stated periods and to keep records of farm yields, acreage, purchases, sales, breeding of livestock, and to give the landlord access to these records.
8. To yield peaceable possession at the termination of the lease.
9. Not to bring on the premises mortgaged property that may have the effect of impairing the landlord's lien.

IV. Assurances and Guaranties by the Landlord

1. To make concessions with respect to rent and other obligations of the tenant in the event of disaster to the farm operations as the result of fire, flood, drought, pestilence, or other conditions over which the tenant has no control.
2. To provide peaceable possession, or to protect the tenant's interests, in event of litigation or seizure of the landlord's title by a mortgagee or other claimant.
3. To release to the tenant the residue of crops, livestock, and other products remaining after the rent or rent share is paid and the landlord's lien satisfied.

V. Agreements With Respect to Credit Furnished by the Landlord

1. Terms on which the landlord is to make advances of money or supplies to the tenant for the purpose of operating the farm.
2. Special and occasional credits to make possible the purchase of livestock and feed, or with respect to the feeding of crops to livestock.
3. Terms of loans on farm implements, workstock, productive stock, or other property of which the tenant is to be the nominal owner or part owner.

VI. RESPECTIVE CONTRIBUTIONS BY EACH PARTY TO OPERATING CAPITAL

1. General farming machinery, running gear, small tools, and harness, with provision for replacement and repair.
2. Special farm machinery not commonly employed, such as manure spreader, lime or fertilizer distributor, spraying outfit, silage cutter and engine, milking machine, gasoline engine, threshing machine, tractor and tractor equipment, with provision for replacement and repair.
3. Horses and other workstock.
4. Productive livestock, including cattle, hogs, sheep, and poultry.

VII. ADJUSTMENTS WITH RESPECT TO PROPERTY OWNED IN JOINT ACCOUNT

1. Method of appraising the value of property of either party taken over for joint account.
2. Method of dividing property jointly owned at termination of lease.
3. Settlement for undivided crops, products, or supplies used by the tenant in his household, for his horses or other stock.

VIII. RESPECTIVE CONTRIBUTIONS BY EACH PARTY TO EXPENSES

1. Contributions of Labor and Special Services:
    - (a) Amount of labor to be contributed by each party to general farm work.
    - (b) Special arrangements with respect to the employment of members of the tenant's family.
    - (c) Arrangements with respect to extra hired labor and labor engaged in threshing, silo filling, baling, shredding, clover hulling, and other operations involving the employment of machines not owned by the tenant.
    - (d) Responsibility of the respective parties with regard to hauling and delivery of crops, milk, and other farm products, hauling supplies for farm use, hauling tile, sand, lumber, fencing, and other materials used in making farm improvements.
    - (e) Furnishing of skilled labor or unskilled labor employed in fencing, tiling, repair or construction of buildings, drilling of wells, or other work of farm improvement.
    - (f) Contribution of labor employed in mowing, grubbing, or pulling weeds and brush, cleaning ditches and drainage outlets.
    - (g) Contribution of labor employed in keeping up fences and in incidental patching and repairs to improvements.
    - (h) Arrangements for the board and lodging of outside labor, particularly of labor employed by the landlord on farm improvements.

2. Expenses on Account of Livestock:

   (a) Use of feed purchased or produced on the farm. What stock may be fed from undivided feed and what stock may not be so fed. Limitations on the amount of undivided feed which may be used for different classes of stock or on the number of stock which may be fed.
   (b) Breeding and veterinary fees; cow testing, registration, and exhibition fees; livestock insurance; horse-shoeing and other incidental expenses in connection with productive livestock or workstock.
   (c) Sharing of losses from injury, depreciation, or death of livestock.

3. Other Expense:

   (a) For seed, including grass, clover, alfalfa, and cover crops, general farm crops and plants used in the raising of truck crops, small fruits, and tobacco.
   (b) For setting out or caring for fruit and ornamental trees and hedges.
   (c) For barrels, boxes, crates, bags, bagging, baskets, cans, and other containers.
   (d) Manure, lime, phosphates, and other fertilizers.
   (e) Spray material for field crops and fruit trees, material for treatment of seed and inoculation of soil for legumes.
   (f) Machine bills for threshing, ginning, shredding, baling, silo filling, clover hulling, and corn shelling.
   (g) For coal, gasoline, and oil for farm use, binder twine.
   (h) For telephone.
   (i) Storage, freight, buying, and marketing costs.
   (j) Insurance on farm crops, feed, supplies, and implements.
   (k) Taxes on property other than real estate, water assessments, and irrigation-ditch upkeep.
   (l) Real estate insurance and taxes, including school and road taxes.
   (m) Expenses for hiring additional pasture and other land outside of the regular farm area.

IX. PAYMENT OF RENT

1. Cash rent for entire farm or portions thereof, with specifications as to amount, time, and place payable.

2. Rent payable in terms of a fixed quantity of a farm product, with specifications as to amount, quality, time, and place payable.

3. Rent share of the various farm products with specifications concerning time, place, method of division, and responsibility of tenant for delivery.

4. Specified quantities of milk, butter, eggs, firewood, feed, fruit, and other products for landlord's household use, and arrangements with respect to delivery of the same.

X. PRIVILEGES FOR WHICH SPECIAL RENT IS OR IS NOT TO BE PAID

1. The farmhouse, habitation for laborers, and buildings for livestock, tools, and crops harvested.
2. Garden spot, and pasturage for limited number of stock.
3. Use of small areas of land for raising special forage crops.
4. Use of fruit, firewood, milk, eggs, butter, and other products for tenant's household or for laborers' households.
5. Use of undivided grain, hay, or other crop for livestock kept by the tenant for his personal advantage.

XI. SPECIFICATIONS WITH RESPECT TO THE CARE, USE, AND IMPROVEMENT OF REAL ESTATE AND ARRANGEMENT FOR LABOR AND MATERIALS USED OR NEEDED FOR THESE PURPOSES

1. Fruit, shade trees, forest trees, and down timber.
2. Drains, ditches, bridges, and roads.
3. Time, frequency, and manner of mowing weeds and brush in pasture, along roads and fence rows, and about buildings.
4. Windmill, engine, and pumps.
5. Buildings, fences, and gates.

XII. SPECIFICATIONS WITH RESPECT TO FARMING METHOD AND PROCEDURE

1. Specifications as to acreage, location, and rotation of various crops.
2. Enumeration of crops which may not be raised.
3. Special regulations with respect to the method of growing each crop, including the details with respect to preparation of the land, time and manner of planting, kind of seed, method of manuring or fertilization, subsequent care, harvesting, storage, and marketing, or time and manner of division.
4. Limitations or restrictions on the sale or removal of crops, on the pasturage of crops, and on the burning or removal of straw, fodder, manure, and so forth.
5. Number and kind of livestock to be kept and the upper and lower limits of the same.
6. Regulations with regard to the number of stock which shall be allowed to run on pasture and times when pastures may or may not be used.
7. Provision for the ringing of hogs and prohibition of the keeping of breachy livestock.

Specifications respecting the methods of farming and the procedure to be followed may be made clearer if, when they are made a part of the lease, they are accompanied by a map of the farm. Such a map may show such details as the use made of the land in past years, previous rotation system, present use of the land, rotation to be followed in the future, the drainage system, past and present policies with respect to clearing, liming, manuring, and fertilizing.

XIII. PROVISION FOR SUPERVISION

1. Provision with respect to kind and extent of supervision for which each party will be responsible.

XIV. PROCEDURE AT TERMINATION OF LEASE

1. Disposition of crops growing, unfed or unsold, or of feed and supplies remaining on hand.
2. Disposition of farming equipment, work animals, and other livestock owned on joint account.
3. Specification of number of acres which must be left plowed, seeded down, planted in wheat or other crops, or in pasture.
4. Compensation for improvements made by the tenant, including construction of buildings and fences, digging of wells, drainage work, clearing of land, setting out trees and small fruits, planting of hops, asparagus, rhubarb, or other perennial plants.
5. Compensation for unexhausted additions made by the tenant to the fertility of the soil.
6. Authority for removal of improvements made by the tenant without assistance or compensation by the landlord, such as fences, hog houses, corn cribs, water troughs.
7. Settlement of outstanding indebtedness.

XV. ENFORCEMENT OF CONTRACT

1. Provision for the settlement of disputes and differences of opinion by arbitration or otherwise.
2. Provision for fulfillment of terms of the contract by heirs, executors, administrators, or assigns, in the event of death or disability of one or both parties.
3. Conditions that will constitute a forfeiture of the lease, and method of determining rights of landlord and of tenant in the event of termination by forfeiture.
4. Provision for penalty to be paid by either party according to a stated scale in the event of failure to perform certain agreements in the contract.
5. Right of the owner to have work which is neglected by the tenant performed at the tenant's expense.
6. Acknowledgment of the existence of a lien to secure to the land-

lord the payment of the rent and the performance of specified agreements.

XVI. Final Details

1. Signatures of the parties and their witnesses.
2. Sealing and recording.

It should be emphasized that these provisions do not in themselves make a written lease. They are rather things which should not be overlooked when a lease is being written. Neither is it advisable or often necessary for every farm lease to contain clauses covering all the things enumerated by Gray and Turner.[5] The farm lease should, above all things, be brief, simple, and legal in form. Any complicated features or details relating to the system of farming or to the farm practices should, as a rule, be relegated to addenda. An addendum, when reference is made to it in the main body of the lease, is legal and binding, just as much as if it were inserted in the lease itself.

The following contract is presented to indicate the nature of a written lease and the method used in preparing such a lease.

SHARE LEASE CONTRACT FOR THE OPERATION OF FARM

....
(Name of Farm)

Owned by

....
(Name of Owner)

This agreement made and entered into this .. day of ...., 19.., by ...., hereinafter designated the owner, and
(Owner's Name)
.................., hereinafter designated the farm operator, agree
(Tenant's Name)
to the following conditions relative to the operation of ....
(Name of Farm)

---

[5] Gray, L. C., and Turner, Howard A., "The Farm Lease Contract," *Farmers' Bulletin 1164,* U. S. Department of Agriculture, April, 1930.

farm, which is located on .... road, ... miles from ......
(Name of Road) (City or
......, in .... County, State of .... This agree-
Town)
ment will cover all farm enterprises on said farm with the exception of ...., which will be operated by ....
(Exception) (Name of Party)

I.

The owner agrees:

1. To furnish all the land consisting of ...... acres, more or less, essential and necessary farm equipment for the planting, cultivation, and harvesting of crops or the growing, care, and marketing of livestock hereinafter mentioned, necessary power, consisting of

....
(Name, Type, Source of Power)
to do the farm work, and buildings, consisting of

....
(Name of Buildings)
with such other buildings, machinery, equipment, and power as may be mutually agreed upon as necessary to the successful operation of the .... farm.
(Name of Farm)

2. To provide a dwelling to be occupied by the operator during the term of this contract and to give the operator the privilege of harvesting wood sufficient for his own home use on the farm, to be cut at the operator's expense and in such places on the farm as may be designated by the owner.

3. To maintain in good repair all buildings and equipment owned by the owner.

4. To provide ...... truck(s) and/or ...... automobile(s) to be used for farm purposes only and the operating and maintaining charge of the said truck(s) and/or automobile(s) at a rate not to exceed .... cents per mile.

5. To pay the operator for specified farm work designed to improve farm property or for the other purposes at wages to be mutually agreed upon by both parties.

6. To divide with the farm operator the products or proceeds therefrom produced on the farm as indicated in addenda attached to this contract.

7. To pay the following farm operating expenses:

....
(Share) (Expenses)
....
....
....
....

....
....
....

8. To pay all taxes of the farm property owned solely by the landlord.

9. To pay insurance premiums on the following:

....
(Share) (Object covered by insurance)
....
....
....
....

10. To keep an accurate record of the farm business during the year and to make available to the tenant a summary of such records on or before ...., 19 ..
(Date)

11. In the event that enterprises other than those designated in the addenda become a part of the farming system during the term of this lease, the owner agrees to divide with the farm operator the products grown on a basis mutually agreed upon by the owner and the operator; and said division to conform as nearly as possible with the contribution of each party to these additional enterprises.

II.

The farm operator agrees:

1. To furnish all of the labor necessary to a satisfactory production of crops, care, and maintenance of livestock.

2. To plant, cultivate, and harvest all crops and care for livestock in a workmanlike manner, according to written instructions to be given by the owner.

3. To pay .... cents per mile for the cost of operating and maintaining .... truck(s) and/or .... automobile(s) and to keep an accurate record of the mileage of said truck(s) and/or automobile(s) used by the operator in doing farm work, marketing, or any other duty incident to the operation of the farm.

4. To control, according to instructions given by the owner, all destructive weeds, insect pests, and plant diseases, or, in the event of failure to do so, to permit the owner to do so and charge the same to the account of the operator.

5. To keep a complete labor record of all work done on the farm. To keep a financial record of all products sold off the farm or used in the home, and a record of all expenses incurred by the operator for farm operation.

6. To sell to the owner at current market prices all surplus feed, unless disposed of in a manner mutually agreed upon by the contracting parties.

7. Not to sell, or in any way dispose of, any crop or livestock

products produced on the farm unless specifically authorized to do so by the owner, and, in the event of such disposition, faithfully to record the sale or disposition of such products.

8. To maintain on the farm not more than .... dairy cows to supply dairy products for the operator's own use.

9. Not to keep on the farm any dogs or pet animals, chickens or other type of poultry, for the operator's own use or pleasure, unless specifically permitted to do so in writing by the owner.

10. To landscape, by planting shrubs and flowers, the farmstead in accordance with instructions given by the owner and to maintain the farmstead at all times in an orderly and attractive condition.

11. To pay the following farm operating expenses:

....
(Share) (Expenses)
....
....
....
....
....
....
....
....
....

12. To pay interest on the cost of fertilizer, seed and/or plants, etc., at the rate of .... per cent per annum, in the event that funds are advanced by the owner for the purchase of these items.

13. To yield possession of .... farm to the owner
(Name of Farm)
without further demand or notice except as hereinafter indicated and in the condition satisfactory to the owner.

III.

The owner and operator mutually agree to the following provisions:

1. That the landlord, or other persons designed by him, heirs or assigns, shall have the right to enter said premises at any time for any purpose associated with the operation of the farm and/or other purposes not detrimental to the interest of the operator.

2. That in case of misunderstanding between the landlord and the operator regarding the operation of the farm, the division of the crop and livestock production, and/or any other thing associated with the operation of the farm, and if said differences of opinion cannot be adjudicated by the landlord and the operator, then each reserves the right to appoint an arbitrator who, together with a third arbitrator to be selected by those appointed by the landlord and operator, constitutes a board of arbitration, and that the decision of this board shall be final.

3. That this contract may be terminated .... , next, or
(Day of Month)

on .... of any year hereinafter, by written notice of either
(Day of Month)
of the parties to this agreement on or before .... of the
(Day of Month)
year preceding.

4. That any changes in the organization of the cropping system or livestock enterprise or in the farm practices not specifically provided for in this contract can be made only with the consent of both parties and such changes in the cropping system, livestock enterprise, or farm practices to be stated in writing and attached as addenda to this document.

IV.

IN WITNESS WHEREOF, We affix our signature this ... day of ...., 19...

Signed and executed in the presence of:

....	....
(Witness)	(Landlord)
....	....
(Witness)	(Tenant)

State of ....
County of ....

Before me, ..., a Notary Public in and for said county and state, on this ... day of .... 19..., personally appeared ...., landlord, and ...., operator, to me known to be the identical persons who executed the foregoing contract, and acknowledge the same to be their free and voluntary act and deed for the use and purpose therein set forth.

Witness my hand and official seal this ... day of ...., 19...

(SEAL) ....
(Notary Public)

My commission expires ...., 19...

5. Advantages and Disadvantages of the Written Lease

The written lease, as described in Section 4, has several distinct advantages over an oral one. These have been stated succinctly by Case and Ackerman.[6] The specific advantages are:

1. A written lease that provides for the more important farm practices will, in case of a dispute, prevent the applica-

---

[6] Case and Ackerman, *op. cit.*

tion of interpretations growing out of common law, custom, or court decisions which are unadapted to the farm.

2. A written lease serves as a memorandum to which either landlord or tenant may refer in case of doubt as to the terms of their agreement; and it therefore serves as a means of preventing disputes.
3. It affords a basis for changing minor provisions when conditions arise which make adjustment desirable.
4. It protects not only the original parties but their heirs and assigns, in case either party should die.
5. It gives assurance that both parties will consider all phases of the contract.
6. When details of farm operation are specified in the lease, the lease serves as a history of the operation of the farm.

The written lease, although desirable, is not without its disadvantages. A verbal agreement is to be preferred, and indeed is a type most commonly used, when there is unequal responsibility either financially or in a moral sense between the parties to the contract. When, for example, the tenant possesses no, or very little, legally attachable property, or is morally irresponsible, or when the risk from sickness may be great, a verbal understanding may be more convenient to the landlord than the written one. In such cases, the landlord is subject to legal action for any breach of the contract and can be held responsible, because he possesses legal attachable property in excess of exemption; whereas the tenant, being without property, cannot be held, although a judgment may be obtained against him. Any written contract is then a decided handicap to a person who may be held legally and financially responsible for the breach of contract or an alleged breach of contract. It is for this reason that in many cases the landlord prefers a verbal agreement—not that such an agreement is not legal, but a judgment in case a suit is brought against him by an irresponsible tenant is more difficult to obtain than if the lease were in writing.

A second disadvantage of the written agreement is the legalistic phraseology used in defining the terms, describing the provisions, and stating the responsibility of the parties to the contract. The provisions are sometimes so worded that it is difficult to determine exactly what is meant. Hence, both the landlord and the tenant may hesitate and they often do hesitate to sign contracts drawn by a lawyer. It is much easier to understand the spoken word, and it is also more subject to varying interpretation and modification. If a provision of an oral agreement is not carried out, either one of the parties may claim that there is a misunderstanding as to the exact nature of the provision itself. It is for this reason—latitude or flexibility in the interpretations—that the majority of the agreements are verbal.

A third disadvantage, as already indicated, is a rigidity of the lease itself. The provisions, even when they are stated clearly, may offer little opportunity for the exercise of the judgment by either the tenant or the landlord. And as many tasks on the farm must be done, not after deliberation but on the spur of the moment, the tenant or landlord may hesitate to act for fear of being held for a breach of contract, especially if the action results in severe loss. The tenant may, for example, be faced with the problem of determining what action to take in the case of one or two alternatives in the performance of some farm task. The written lease, if consulted, prescribes a definite and clearly worded direction as to how this task should be done; but in this particular case an emergency has arisen which is not covered in the contract as such. What should the tenant do? Should he use his own judgment or take no action at all? In either case he may be liable. To write a contract that would be flexible enough to take care of all emergencies would be, of course, impossible, but often a clause may be inserted, which, within certain prescribed limits, permits the exercise of judgment in the case of emergencies by either landlord or tenant. But even so, a written lease is often considered a real handicap if either of the parties to the contract are contentious or in any way irresponsible troublemakers. Legal action is to be avoided, if possible, and many landlords believe that legal action is less likely to be taken by tenants if the agreement is oral. Or if the action is taken by the tenant, the chance of a decision favorable to the tenant is much less if the agreement is oral.

Questions

1. Discuss briefly the types of share-rental contracts.
2. On what basis is the division of receipts made in these contracts?
3. What is the usual relationship between land and labor in share-rental contracts?
4. Why do owners in the South get one third of the corn and only one fourth of the cotton under the same type of contracts?
5. Describe a method of drawing up an equitable share-rental contract.
6. List the factors which should determine the most desirable contract for any given tenant.
7. Name and discuss the chief advantages and disadvantages of a lease.

References

Adams, R. L., *Farm Management.* New York: McGraw-Hill, 1921, Chapter XXIV.

App, Frank, and Waller, Allen G., *Farm Economics.* Philadelphia: Lippincott, 1938, Chapter XI.

Boss, Andrew, *Farm Management.* New York: Lyons and Carnahan, 1923, Chapter IV.

Spillman, W. J., *Farm Management.* New York: Orange Judd, 1923, Chapter XXI.

Taylor, H. C., *Outlines of Agricultural Economics.* New York: Macmillan, 1931, Chapters XXII and XXIII.

Warren, G. F., *Farm Management.* New York: Macmillan, 1916, Chapter X.

Illinois Experiment Station Circular 474, "Farm Leases for Illinois," by H. C. M. Case and Joseph Ackerman, June, 1937.

U. S. Department of Agriculture, *Department Bulletin 650,* "Lease Contract Used in Renting Farms on Shares," by E. V. Wilcox, February, 1918.

U. S. Department of Agriculture, *Farmers' Bulletin 1164,* "The Farm Lease Contract," by L. C. Gray and Howard A. Turner, April, 1930.

Wisconsin Agricultural Experiment Station Research Bulletin 47, "Farm Leasing Systems in Wisconsin," by B. H. Hibbard and J. D. Black, October, 1920.

CHAPTER XXV

The Cash Rental Contract

WHETHER or not a farm is rented for cash or for a share of the production, the problem of contract-making is the same. When a farm is rented for cash, the emphasis is placed on the amount of rent that should be paid for the use of those factors of production owned or controlled by the landlord. The amount of cash paid is not an arbitrary thing. On the contrary, it is determined by the interaction of economic forces, custom, tradition, and kinship. In the main, cash rents are affected more by the income-yielding power of the farm than by any other factor. That is, other things being equal, the cash rents paid will depend upon the power of the farm to yield income. The greater this power, the greater the rent. It may be customary to pay a given cash rent per acre, irrespective of economic conditions. However, the force of custom will normally be weakened if economic conditions change markedly and continue altered over a long period. To illustrate, if in any given area customary rents are lower than economic rents, then, as the demand for land increases, there will be a tendency for customary rents to rise in response to the demand of tenants for land. If this does not occur, then there will be a tendency for landowners to sell their farms and to invest their funds in other and more lucrative undertakings. If, on the other hand, customary rents tend to be higher than economic rents, tenants will move to other areas where rents are more favorable. Thus, there will be a slackening in the demand for farms. In the end, especially in a country where tenants are free to move from one area to another, the contract rent will bear a close relationship to the economic rent.

Almost invariably an advance in farm prices is followed by a rise in rent. Rents also will tend to rise, when the price of farm products remains the same and expenses of production will tend to decline. As prices and costs are constantly changing, economic rents also change. These year-to-year changes in the economic rent affect the amount of cash or contract rents that the tenants can afford to pay. Obviously, if the income-yielding power of the farm declines, the tenants cannot afford to pay as high cash rents as formerly. For the tenant, it is important to know just how much the economic rent has advanced if an increase in the cash rent is demanded by the landlord. But there is a more important thing that the tenant should know—namely, whether or not in fact the cash rent is at any time fair.

1. Methods of Determining When Cash Rents Are Fair and Reasonable

There are three ways open to the tenant by which he may determine whether or not in any given case the cash rent demanded is indeed fair and reasonable. These three ways may be designated as (a) the observational method, (b) the sliding-scale method, and (c) the budget method.

a. Observational method. This method is the one most commonly used by tenants. It consists mainly in observing the cash rent actually paid in the community where the farm to be rented is located. The procedure is first to inquire of cash tenants how much they are paying, and to observe the character of the farms they are renting; that is, to note in each case whether or not the farm is average, better than average, or below average. Then, from these observations, the farm to be rented is appraised as to whether or not it is an average farm or below or above the average. If, for example, the average cash rent is $5 per acre and the farm is average, then any demand on the part of the landlord for a higher rent should be carefully scrutinized by the prospective tenant.

The personal observations may be checked by comparing such observations with published data. Not infrequently the tenant may get from the state or federal government data on cash rents in a given community; or he may be able to get advice from the state agricultural economist or others familiar with the conditions in the locality where the farm is situated. In this connection it may be said that the former tenant on any specific farm may be an excellent source of information. He may be able to give the prospective tenant information as to whether or not the proposed rent is fair.

b. **Sliding-scale method.** Mr. Millard Peck has suggested a method of adjusting cash rents. He proposes to adjust cash rents according to changes in current prices of farm products. That is, Mr. Peck proposes that the cash rents be made to depend upon the prices of representative farm products for the year covered by the rental contract. Just how are rents to be adjusted according to this plan? To illustrate this plan Mr. Peck applies it to Iowa farm conditions. The prices of ten Iowa farm products are selected for this purpose.[1] These products are not equal in importance; accordingly, Mr. Peck weights these prices. These weighted prices are not used in their original form but are converted into index numbers, the base used being the weighted average price of ten Iowa farm products from 1910 to 1914.

As it is seldom possible to use an index number for a full year, inasmuch as the final settlement must be made prior to the end of the year, it is necessary to use an index number representing somewhat less than twelve months. In view of this, the monthly indices are added and then divided by the number of months used. For example, suppose the sum of the monthly index numbers from March to January, inclusive, is 890. Then, 890 divided by 11 (the number of months used) gives 81 as the index number of the prices of specific farm products for the lease year. According to Mr. Peck's plan, the cash rent should be in proportion to this average of the monthly index numbers. Suppose that the average cash rent of a farm from 1910 to 1914 was $5.80 per acre (for this same period the index number of the specified farm product would be 100) and that for the year 1930 the index number was 120, then the rent should be, according to this plan, 20 per cent higher than the rent in the base period, or $6.96 instead of $5.80. In short, the cash rent on any given farm would be adjusted annually according to the annual changes in the index of farm prices.

---

[1] Peck, Millard, "A Plan for Adjusting Cash Rent to Changes in the Prices of Farm Products," *Iowa Bulletin No. 295.*

To make this plan operative in any given case, all that is required is to insert in the cash farm lease a provision to this effect.[2]

> The tenant shall pay to the landlord, as rent per acre for the above described farm, an amount proportional to the simple average of the monthly index numbers of the prices of the ten (name of state) farm products for the months of March, April, May, June, July, August, and September, computed and published by the Department of Agricultural Economics (name of state college or other agency), the rent being proportional to said average as shown in the following table.
>
> If the simple average of the monthly prices of farm products for the eleven months specified above is:
>
> 150, the rental shall be..........per acre
> 140, " " " " .... " "
> 130, " " " " .... " "
> 120, " " " " .... " "
> 110, " " " " .... " "
> 100, " " " " .... " "
> 90, " " " " .... " "
> 80, " " " " .... " "
> 70, " " " " .... " "
> 60, " " " " .... " "
>
> The rental shall be paid in two installments, the first being due and payable on ... ., 19..., in a fixed amount of .. ... .
> (Month)
> per acre, the second on ...., 19.... The amount due
> (Month)

---

[2] *Ibid.*

and payable on ...., 19..., shall be the full rental for
(Month)
the period of the lease as computed according to the table above, less any installment or installments previously paid.

c. **The budget method.** The sliding-scale plan is based on the assumption that the rent for the base year is a fair or just rent. As a matter of fact, the rent in any base year may be fair or unfair. For the average farm in any given locality, assuming that economic forces have had free play, the cash rent will be approximately correct. But for any given farm in any given year, the cash rent paid may not be in line with the economic productivity of the farm. If, in any given case, the rent is not in fact a fair rent, how can the tenant or the landlord or both arrive at an approximately correct cash rent? The question may be put in this form: What rent should be paid for a specific farm for a specific year?[3]

This question may be answered, at least in a tentative form, by using the method outlined in Chapter IX. This method calls for orderly and systematic calculations of probable receipts and costs. It presupposes a knowledge of the products to be grown and the amount of each product that will be grown and the probable cost and prices. It is not necessary to restate the method suggested. The income statement of Farm "A", as presented in Chapter IX, may be used to show how such a method may be modified to show what rent can be paid for the use of a farm (see Table 87).

The net income of Farm "A" in 1927 was $1,790. This net income should be corrected first by omitting taxes of $128 from the expense, as this sum is to be paid by the landlord and not by the tenant. The corrected net farm income is then $1,918. From the corrected net income should be deducted $300 for unpaid family labor, $500 for the operator's labor, and a sum for the wages of management. Let

---

[3] It should be pointed out that this does not mean what rent will actually be paid but rather, from the point of view of the tenant or the landlord or both, what would constitute a fair rent.

TABLE 87

HOW THE BUDGET METHOD MAY BE USED TO DETERMINE A FAIR CASH RENT

Total receipts (see Table 39, Chapter IX)	$2,804	
Expenses (less $128 for taxes)	886	
Difference		$1,918
Less estimated value of family labor	$ 300	
Less estimated value of operator's labor	500	
Less estimated value of manager's labor	500	
Less 5% on tenant's capital ($1,502)	75	1,375
Possible net cash rent		543
Less taxes		128
Net return to landlord		$ 415
Per cent return on landlord's investment		3.015

us say tentatively that this sum is $500. In addition to these items the tenant would probably feel justified in subtracting a sum for the use of his investment in livestock, workstock, and equipment of $1,502.[4] Let us suppose further that the return of 5 per cent, or $75, is claimed by the tenant for this investment. The total deduction made by the tenant from the corrected net income will be $1,375, leaving a net sum of $543 as the probable maximum rent which the tenant would be willing to pay for the use of this farm.

It is to be observed that the word "would" is used rather than "must." The landlord may have a different idea as to the amount of rent which indeed should be paid. He would have to consider what rent would yield a reasonable return on his estimated investment of $13,765. It should also be pointed out that $543 would not be net to the landlord, for out of this amount he must pay taxes of $128, leaving a net cash rent above taxes of $415, or 3 per cent on his estimated investment.

It is clear from these figures that either the cash rent thus calculated by the tenant is too low or the valuation placed on the land and buildings is too high. The landlord will probably not accept less than what he thinks is a reasonable rate or return on his investment. The tenant would not be willing to pay a rent that would reduce his net income to the point where it would not afford a reasonable wage and a fair return on his investment. Yet, the two must arrive at some agreement. In this particular case, the tenant will probably have to pay a somewhat higher rent than he had first anticipated, and the landlord will not be able to obtain more than a nominal rate upon the estimated value of his land and buildings. Let it be supposed, for example, that the bargaining between the two parties results in a rent of $650. This would give the tenant $1,268, instead of $1,375, as a reward for his labor, management, and interest; and the landlord 4.5 per cent, instead of 3.0 per cent, on his investment.

---

[4] It is assumed that since the farm is being rented for cash, the tenant will supply all the livestock, workstock, and necessary implements.

The amount of rent paid in any actual case will depend on the bargaining power of the parties to the contract. However, the bargaining may be done more intelligently by proceeding along the lines suggested above, that is, by actually projecting into the future a tentative budget of farm income and farm expenses. It is possible and may be desirable to use a combination of the budget method and the sliding-scale method. After the rent has been decided upon by using the budget method, there is still the possibility that the prices and cost figures used may turn out to be wrong, that is, higher or lower than actual costs and prices. In such a case it would obviously be fair to correct or adjust the contract rent for the changes in costs or prices or both. It is obvious that if actual costs should be 10 per cent lower than those used in preparing the budget and prices 10 per cent higher, the tenant will gain and the landlord will lose by the contract. Such changes, especially if they are marked, to be entirely fair, ought to be provided for in the contract; and the corrections in the net rent can be made by the sliding-scale method.

Questions

1. Discuss the factors which generally determine the cash rents on a given farm.

2. Discuss the observational method of determining the fairness of cash rents.

3. State the theory on which the sliding-scale method is based.

4. Why is the budget method more likely to result in a fair rental than either the observational or the sliding-scale methods?

5. Describe briefly how the budget method may be used to determine a fair and reasonable cash rent.

References

Illinois Agricultural Experiment Station Circular 474, "Farm Leases for Illinois," H. C. M. Case and Joseph Ackerman, 1937.

Iowa Experiment Station Bulletin 295, "A Plan for Adjusting Cash Rent to Changes in the Price of Farm Products," by Millard Peck, 1932.

CHAPTER XXVI

Credit for Farm Operation

FARMERS, in organizing their production resources and in carrying out various operations, often need more funds than they have at hand. Such funds may be obtained by borrowing from individuals or from lending agencies. That is, the use of credit may be resorted to. Credit means "the power to obtain commodities or services at the present time in return for some equivalent promised at a future date."[1] When this power is exercised, a *debt* is incurred, or an obligation to pay for the present use of funds an exact equivalent at some future time.

Another element must be considered—namely, interest. Normally, an individual or agency will not lend funds unless a premium be paid for their use. This premium is called interest. In addition, therefore, to the face value of the loan or the principal, as it is usually called, the farmer must agree to pay a stipulated amount of interest, which is the charge for using the principal or the amount borrowed. As an obligation of this kind should not be assumed carelessly, it is the purpose of this chapter to discuss briefly the nature of the problems involved.

1. Principles Involved in the Use of Farm Credit[2]

In using credit, there are several principles which should be observed. The first principle is *that credit should be employed only for those purposes which are apt to prove sufficiently productive to enable the borrower to repay the*

---

[1] Bullock, *Elements of Economics*, p. 123.

[2] Carver, *How to Use Farm Credit, Farmers' Bulletin No. 593.*

principal and interest. This principle may be illustrated as follows: Suppose a farmer contemplates borrowing $100 for the purchase of fertilizer. If the fertilizer is not productive enough to increase the farmer's net returns by $100 plus the interest charged on the loan and the extra labor required in applying the fertilizer and in handling the extra produce, it would not be advisable for the farmer to obtain a loan for this purpose. If, however, the fertilizer will add enough to production so that the farmer can repay the loan with interest, together with some profit, it would be advisable to borrow. In every case, the prospective debtor should make sure, or as sure as circumstances will permit, that he can use the funds to advantage before incurring indebtedness.

The second principle is: *To arrange for the repayment of the loan with the interest at the time when income from the project for which the debt was made will be available.* According to this principle, a farmer should not commit himself to pay the debt at a date prior to the time when the income will be available; otherwise, he may not be able to repay the loan, and his credit standing or his trustworthiness in the eyes of the lenders most certainly will be lowered.

The third principle is: *When the effect of any productive element extends over several years, but the effect after the first year is not sufficient to pay the interest on the principal, the loan made to obtain this element should be repaid at the end of the first year.* The use of agricultural machinery, for example, extends over several years, and the effect on production during the life of the machine is almost as great as it is during the first year. In such a case, it may be advisable to arrange for the loan to extend over a period of several seasons. On the other hand, the effect of fertilizer on production, although it extends over more than one year, does not affect the production after the first year sufficiently to pay interest on the loan. If this is the case, it is the part of good judgment to repay fertilizer loans not later than the end of the first season.

A fourth principle may be stated as follows: *The annual payments in principal and interest should correspond in size to the annual net income expected of the elements for which the loan was obtained, and the period over which the loan is to extend should correspond to the life of the productive element.* In actual practice annual payments are usually of equal size, because it is assumed that the contributions of the productive agent will be the same each year. Of course, this assumption is not always true. The productivity of an element will vary from year to year, and in many cases it will normally decline with continued use. If the productiveness declines, the annual payments should decline also; otherwise, hardships will be imposed upon the farmer in the latter part of the period. That is, the farmer will find it increasingly difficult to meet his obligations, unless a part of the excess returns during the early part of the loan period be set aside as a reserve fund. In some cases, the productivity of an element may increase at first, remain constant for a while, and then decline. In such cases, the payment made annually should correspond to the change in productivity. The principle may be illustrated as follows:

Suppose a farmer needs $20,000 to develop a certain enterprise on his farm. Normally, this loan would be distributed over a period of, say, thirty years, and the annual payments would be equal. Let us suppose that such payments, including interest, are $1,000 per annum. A study of the enterprise shows, however, that for the first five years the returns would not be $1,000, but only $500 per year; from the sixth to the tenth year, inclusive, the income would be $2,500 per year; from the eleventh to twentieth year, inclusive, $1,000 per year; and from the twenty-first to the thirtieth, inclusive, $500 per year. Then, according to the principles stated above, the payments per annum should be arranged as follows: From the first to fifth year, $500; from the sixth to tenth, $2,500; from the eleventh to twentieth, $1,000; and for the remainder of the period, $500. Since varying the payments to correspond with income is not generally practiced, the farmer must set aside from other sources funds to meet the equal annual or semiannual payments.[3]

2. The Basis of Farm Credit

The amount of credit which will be extended to any given farmer will depend largely on the farmer's liquid assets, business integrity, and ability. Liquid assets consist of all those things used in the farm business, owned by the farmer, and readily salable. Although the use of credit involves trust or belief that the loan will be repaid, it is impossible for the lending agency to be sufficiently acquainted with each customer to place such trust in him. Aside from this fact, the lending agencies under legal supervision are required to have some security other than the word of honor of the borrower. Thus, a farmer may be required to give as security for a loan a mortgage on his land, his buildings, or other fixed assets, or he may give his property rights in crops to be produced or in livestock to be purchased. The person or agency making the loan has the right, in case of default, to sell the security given by the farmer.

Even though the liquid assets offered as security are sufficient to cover the loan, a farmer may be refused credit because his business integrity is questionable. Business integrity refers to the willingness and the ability of individuals to carry out promptly any business agreement or contract. The farmer may be honest and desire to pay his debts promptly; but if he lacks business ability, he may fail to live up to his promises. He may lack good judgment; he may be too optimistic regarding the project he has in view; he may not be a good manager and, hence, may fail to realize returns on the funds borrowed. Of course, in such cases, the securities given can be sold, and in most cases the funds invested in the loan may be realized by securities being sold, but such procedure is both expensive and disagreeable.

---

[3] Since this was written, a start has been made in varying the payments in the case of credit extended by the production credit associations.

Credit agencies are, as a rule, reluctant to extend credit to those whose business integrity and ability are questionable.

In most cases when a debtor has been doing business with a lending agency for any length of time, he will be given a credit rating. This rating is based upon the net worth of the individual, upon his business ability and integrity, and upon the record of the debtor. Developing a credit rating involves the demonstration to the creditor over a period of years that any loans made to the individual will be paid promptly and in full. This rating, together with a detailed statement of the financial condition of the debtor, both actual and potential, will provide a basis for determining whether or not the loan will be made at all, and, if so, the amount that will be lent.

3. Types of Credit Needed

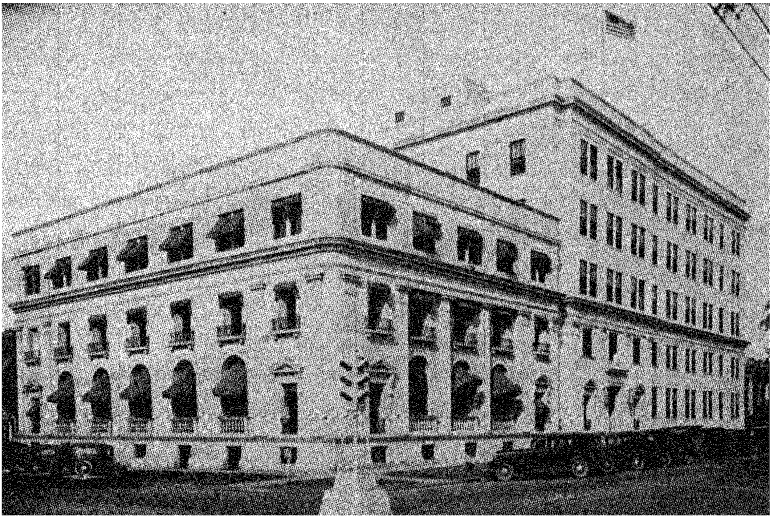
Credit may be needed for a short or a long time, for example, to purchase land, to construct buildings, or to purchase implements, seed, feed, or fertilizer. As a result of this diversity of needs, there have developed three distinct types of credit: namely, (a) short-term credit, (b) intermediate credit, and (c) long-term credit. *Short-term credit* generally includes loans which are made for a period of one year or less. These loans are made primarily for the purchase of feed, seed, fertilizer, or other materials, for the hiring of labor, or for marketing of farm products. *Intermediate credit* refers to loans made for periods from one to three years. These loans are made for feed and materials, for livestock, as well as for the purchase of machinery and equipment. *Long-term credit* is used to obtain funds for the acquisition of factors of production, such as land, buildings, and machinery, which are used for a number of years. This class of credit is more important than any of the other classes. It has been estimated that approximately two thirds of the indebtedness of farmers is made up of long-term loans or farm mortgages.[4]

---

[4] *Yearbook* of the United States Department of Agriculture, 1924, p. 188

4. Sources of Farm Credit

With the increased use of credit by farmers, there has arisen a variety of sources from which loans may be obtained. The most important sources drawn on by farmers directly or indirectly may be classified as follows:



Courtesy of Fed. Land Bank of Columbia, S. C.

Fig. 57. The Home of Farm Credit Administration Units. This building houses the Federal Land Bank of Columbia, the Federal Intermediate Bank of Columbia, the Production Credit Corporation of Columbia, and the Bank for Cooperatives of Columbia.

a. Short-term credit.
  (1) Private individuals.
  (2) Commercial banks.
  (3) Agricultural credit corporations.
  (4) Production credit associations.
  (5) Credit unions.

b. Intermediate credit.
  (1) Private individuals.
  (2) Intermediate credit banks.
  (3) Banks for coöperatives.
  (4) Commercial banks.

c. Long-term credit.
  (1) Private individuals.

(2) Commercial banks and trust companies.
(3) Insurance companies.
(4) Federal land banks.
(5) Mortgage companies.

(a) Short-term loans. Perhaps the most important source of short-term cash loans to farmers is commercial banks. Loans through such institutions to farmers are of comparatively recent origin largely because the turnover of operating capital in agriculture is slower than in industry. The security has been standardized, however, to some extent, and in the last few years commercial banks have supplied large amounts of short-term agricultural credit. Loans are usually secured by crop liens and chattel mortgages on livestock and machinery.

Private individuals, including merchants, landowners, and others, are important sources of short-term farm loans, particularly in some sections. Until recent years when other agencies entered the field, and when the interest charged by individuals was revealed, this group was of the first importance. Even now it ranks first in volume of credit extended in many sections of the South, where the landlord gives the tenant credit and where the supply merchant system prevails. When the individual is used as a source, the creditor and debtor are usually acquainted, so that there is no "red-tape" in making the loan, as is the case with commercial bank loans.

A new short-time credit agency has been created by an act of Congress. The Farm Credit Act of 1933 provided for the creation of production credit associations. The funds for these associations are supplied through production credit corporations set up for this purpose.[5] The loans obtained by farmers through a production credit association are, in general, restricted to a period of one year. Loans must be secured by a first mortgage lien on growing crops, livestock, and other personal property.

---

[5] See *Farm Credit Administration Circular No. 5,* March, 1934.

Loans obtained through a production credit association may be used for general farming purposes, including production and harvesting of crops, breeding, raising, and fattening of livestock, and the production of livestock and poultry products. The minimum loans are $50 and the maximum in any case cannot be greater than 20 per cent of the capital and guaranty fund with the association, unless the borrower's loan is secured by collateral approved by the production credit corporation.[6] When approval is given, an individual loan may be as much as 50 per cent of the capital and guaranty fund. Finally, loans in excess of 50 per cent of the capital and guaranty fund may be obtained, if approved by the Production Credit Commissioner.

In borrowing from the production credit association, farmers are obliged to invest to the extent of 5 per cent of the loan in Class B Stock of the association.[7] Voting rights are confined to Class B Stock, and the holder of this type of stock is entitled to one vote, regardless of the number of shares which he may own.

The Federal reserve banks, although not a direct source, should be mentioned in this connection because they provide a discount market for agricultural paper of member banks, even though such paper has a period of nine months to run. Coöperative marketing associations may also rediscount with the Federal Reserve System papers which mature in nine months. This time limit was extended from six to nine months in 1923, thus giving a type of credit long needed and preventing expensive renewal of loans.

(b) Intermediate credit. The twelve intermediate credit banks are the indirect source of the majority of intermediate loans to farmers. Loans cannot be made direct to farmers by these banks, but these banks can rediscount agricultural or livestock paper running from six months to three years for banks, livestock loan companies, or other credit institutions, and can also make direct loans to cooperative marketing and purchasing associations on warehouse receipts or livestock mortgages.

---

[6] See *Circular No. 5,* 1934, p. 28.

[7] Class A Stock of these associations is purchased by the production credit corporation.

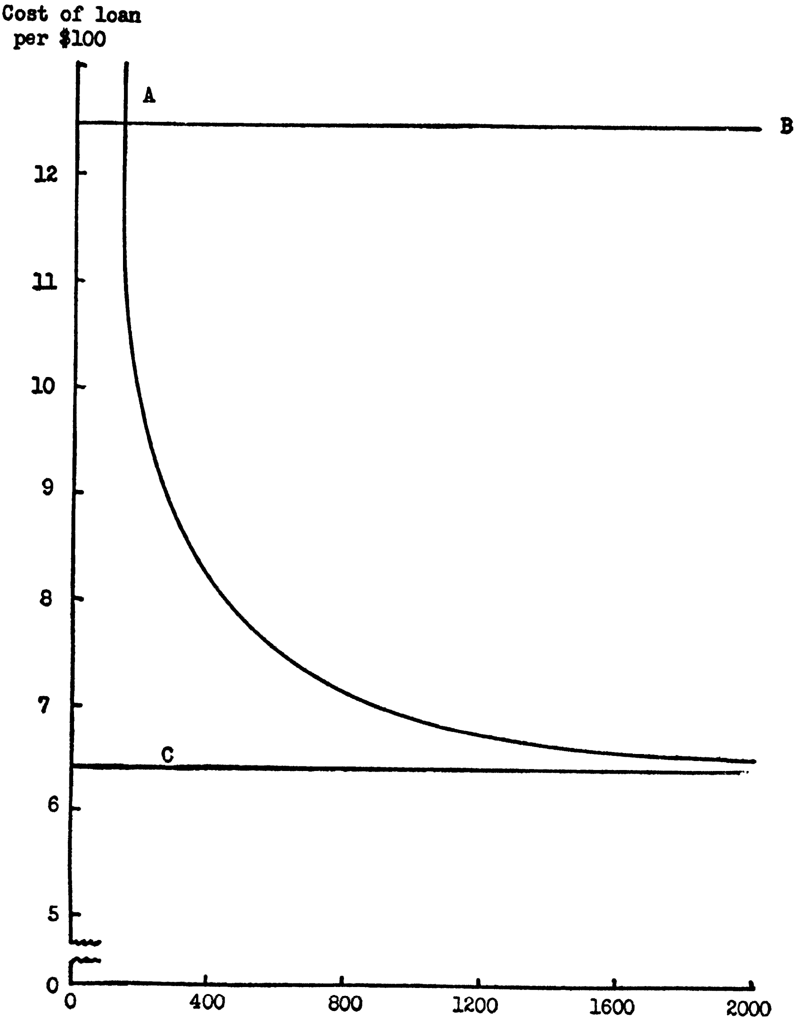
Commercial banks provide another direct source of intermediate farm credit. Their ability to supply such credit has been increased by rediscounting privileges accorded them by the intermediate credit banks. The interest rate which commercial banks (using the discount privileges of the intermediate credit banks) may charge on intermediate loans is limited to the rediscount rate of the intermediate credit banks plus 1.5 per cent. Interest rates on short-term loans are not limited in this way, and, because of this, commercial banks are often reluctant to extend intermediate credit to farmers.

(c) **Long-term credit.** Long-term agricultural credit is much more important than either short-term or intermediate credit; and as a result there is, or has been, a great variety of sources from which loans might be obtained by the farmer.

All of these lenders except the Federal land banks lend directly to farmers. To obtain loans from any one of the Federal land banks, a national farm loan association must be formed by as many as ten farmers who wish to obtain loans aggregating at least $20,000. The Federal land bank in the district in which such national farm loan associations are located then negotiates with farmers through these associations. Important regulations governing such loans to farmers are: Loans may not exceed $50,000 nor be less than $100; loans in excess of $25,000 must be specifically approved by the Land Bank Commissioner.[8] Loans must have a maturity of not less than five years nor more than forty years; each borrower must purchase stock in the association equal to 5 per cent of his loan; loans must be repaid in equal semiannual installments; loans cannot exceed 65

---

[8] Land Bank Commissioner is responsible to the Farm Credit Administration for the policies and activities of the twelve Federal land banks.



Courtesy N. C. Agr. Exp. Station

Size of Loan—Dollars

Fig. 58. The cost of a loan depends upon interest rates, fees, and the method of repayment. "A" shows the variation in cost of loans when fixed fees in addition to interest are charged. The smaller loans are more expensive than larger loans. "B" shows the cost of a loan when the repayments are made monthly, and when no adjustment is made in the prepaid interest. "C" shows the cost of a loan when the interest is deducted in advance, but is paid only on the unpaid balance of the loan.

per cent of the normal appraised value of the land, buildings, and other permanent improvements.

Federal land bank loans may be made for the following purposes: to purchase land for agricultural use; to purchase equipment, fertilizer, and livestock; to make repairs to buildings and other improvements on the farm; to refinance farmers' indebtedness incurred for agricultural purposes; to provide farmers with working capital for farm operations.[9]

5. The Cost of Credit

a. Short-term credit is usually more expensive than are other classes, because the security is usually not so good, and the expense of making the loans is higher. Commercial banks are usually limited to 6, 8, or 10 per cent by law, but by charging fees for investigations, appraisal, by discounting the loan, and by requiring that a part of the loan be left on deposit, they ultimately charge the farmer 12 per cent or more. Rates charged by individuals and merchants, although supposedly subject to regulation, are exorbitant in many cases. Landowner credit to tenants frequently is charged at the rate of 20 per cent or more. Merchants' credit is usually the most expensive, varying from 10 per cent to over 100 per cent.[10]

b. Intermediate credit, particularly when obtained through the Federal intermediate credit banks, is not costly. The discount rate of these banks is limited by the rate paid on the last debentures issued, plus 1 per cent; and the interest rates which other banks and credit institutions discounting with these intermediate credit banks may charge on loans is limited to the discount rate plus 1.5 per cent. Thus, if the debentures are issued at 4 per cent, the discount rate may be 5 per cent and the farmer may have to pay as much as 6.5 per cent interest. The other sources are limited only to the extent as outlined above under short-term loans. Fees and other minor costs add to the cost only slightly.

---

[9] The Emergency Farm Mortgage Act of 1932 authorized the Land Bank Commissioner to make loans not in excess of 75 per cent of the normal value of the land.

[10] Wickens and Forster, "Farm Credit in North Carolina—Its Costs, Risk and Management."

c. Long-term credit usually costs less than any of the other classes. This is because the expense of making the loan is spread over a number of years; the security is also somewhat better, and the rates of two of the important sources are limited by law. The loans of Federal land banks cannot exceed 6 per cent. The interest rates on Federal land bank loans are now (1946) being made at 4 per cent. Costs other than interest include commissions and fees on mortgages.

Questions

1. Define credit.
2. State the four principles governing the use of farm credit.
3. Describe the classes of farm credit.
4. List the important sources of credit of each class.
5. If you were a farmer borrowing for three years to expand the dairy enterprise, what would you give as collateral? From whom would you try to borrow? How would you arrange to pay back the loan?

References

Bergengren, Roy F., *Credit Union.* New York: Beekman Hill, 1931, Chapter III.

Bullock, Charles Jesse, *The Elements of Economics.* Boston: Silver, Burdett, 1923, Chapter VII.

Farm Credit Administration. New York: American Institute of Banking, 1934, Chapters V, VI, VII, and VIII.

Lee, Virgil P., *Principles of Agricultural Credit.* New York: McGraw-Hill, 1930, Chapters I, II, III, V, and VII.

Norton, L. J., *Financing Agriculture.* Danville: Interstate, 1938, Chapters II, VII.

Farm Credit Administration, *Circular No. 5,* March, 1934.

Farm Credit Administration, *Circular No. 16,* "Using Credit Instruments," by James L. Robinson, 1937.

Farm Credit Administration, *Pamphlet,* "Agriculture's Need for Special Credit Facilities," by James L. Robinson.

North Carolina Experiment Station Bulletin 270, "Farm Credit in

North Carolina—Its Costs, Risk and Management," by David A Wickens and G. W. Forster, 1930.
United States Department of Agriculture, *Farmers' Bulletin 593*, "How to Use Farm Credit," T. N. Carver.
United States Department of Agriculture, *Yearbook,* 1924.

Index

A

Accounting terms, 397
Accounts, farm, 394–428
  books of, 396–397
    use of, 398–400
  classification, 403
  closing ledger, 418–420
  Columnar method, 420–426
  defined and described, 376–377
  function of, 391–392, 395–396
  inventory and financial statement. 403–404
  method of collecting information, 99–100
  name of, 402–403
  nature of simple, 394–401
  number of, 402–403
  numbering, 400–401
  results, analysis of, 426–428
  scheme of, 395–396
  set of simple, 402–420
  system of, 63–64
Ackerman, Joseph, and Case, H. C. M., *Farm Leases for Illinois*, 440, 452
Acquisition of farm, 272–295
  economic factors affecting, 273–277
  legal aspects, 292–295
Adjustments:
  day-to-day, making, 339–340
  in working capital, 342–343
Aereboe, Friedrich, 38–39, 40
Agricultural Economic Research Institute, 41
Agricultural Experimental Station, University of Illinois, 356
Allocation of farm resources:
  problem of, 72–76
  rules for, to farm enterprises, 76–80
Analysis:
  farm, standard systems, 139–142
  least-cost, determining input, 206–210
  marginal, determining input, 211–212
  method of:
    combination of factors and returns, 104–110
Analysis (*Cont.*):
    direct comparison method, 100–110
    efficiency factors or input-output relations, 104
    factors affecting returns, 101–104
    summary of year's business, 101
Animal units, 172–173
Animals, *see* Livestock
Appraisal, farm, 288–292
  blank for, 289–290
Area, net returns and, relation between, 253–256
Art, farm management as, 21
Assessed value, as measure of farm size, 169
Assets:
  defined, 397
  journalizing, 404–406
Assignment of tasks, 330–335

B

Bailey, Liberty Hyde, 199
Baker, O. E., 34
Benedict, M. R., *Opportunity Cost Basis of the Substitution Method in Farm Management*, 148–149
Bennett, M. K., *Farm Cost Studies in the United States*, 30
Black, J. D., 35
  Production Economics, 185
Blum, Lester, *Work Simplification News Letter*, 325–326
Bookkeeping terms, 397
Books of accounts, 396–397
  use of, 398–400
Bordiga, Oreste, 46
Boss, Andrew:
  Farm Management, 19–20, 22
  Relation of Variations in the Human Factors to Financial Returns in Farming, 217
Brannen, C. O., *Relationship of Land Tenure to Plantation Organization*, 3

Breeding record, 391–392
Brodell and Cooper, *Requirements and Cost for Picking, Snapping, and Sledding Cotton in Western Texas and Oklahoma*, 220
Budget method, determining fairness of cash rental contract, 460–462
Buildings:
  size of farm determining, 259–260
  supplementary relations, 57
Bureau of:
  Agricultural Economics, 34–35, 367
  Internal Revenue, 352
  Markets, 35
  Plant Industry, 32
Business, farm management as, 21–22
Buying, advantages in, size of farm, 268–269
By-products,
  factor in production, 58–59
  size of farm determining, 265–266
  utilization of, 68, 159–160

C

Canals, affecting farm layout, 234
Capacity, measuring, 184–185
Capital:
  accounts, 395
  earnings, calculating, 186
  farm layout effect on, 241–243
  investment in farm, 1–2, 10
  quasi-capitalistic enterprise, 2
  size of farm determined by, 256–259
  utilization of, effect of methods on, 222–225
  working, *see* Working capital
Carter, R. M., *Labor Saving Through Farm Job Analysis: 1. Dairy Barn Chores*, 222
Case, H. C. M., 357
Case, H. C. M., and Ackerman, Joseph, *Farm Leases for Illinois*, 440, 452
Cash income, calculating, 187–188
Cash rental contracts, 431, 456–462
  fair and reasonable, determining, 457–462
    budget method, 460–462
    observation method, 457–458
    sliding-scale method, 458–460
Catasto, 46
Census:
  Fifteenth, 273
  Fourteenth, 287
  1930, 321
Chain farming, 354–355, 360
Church, *Farm Tractors in Minnesota*, 313
Civil War, farming before and after, 1
Climate, influence of, 154
Collins, E. R., *Instruction on the Mechanical Application of Fertilizer for Cotton in North Carolina*, 223
Colonial farming, 1
Columnar method of farm accounts, 420–426
Communism in Russia, 42–46
Comparative advantage, law of, 152–154
Competing enterprises, factor in production, 55, 56
Complementary enterprises, factor in production, 56, 58
Composite crop index, measuring productiveness, 181–182
Contract rent, relation between economic and, 273–275
Contracts, rental, *see* Rental contracts
Controlled experiments, 198–199
Cooper and Brodell, *Requirements and Cost for Picking, Snapping and Sledding Cotton in Western Texas and Oklahoma*, 220
Coöperation, developing in labor, 335–336
Coöperatives, 11
  in Italy, 47
  production control through, 12
Corporation farming, 350–354, 360
Costs:
  credit, 474–475
  equipment, initial, power selection factor, 315
  fixed, influence on production, 16–17
  least-cost analysis, determining input, 206–210
  marginal, 211
  power, 310–312
    for drawbar work, 260
  studies of Agricultural Section of Patent Office, 28–29
  transportation, increase in, reason for diversification, 160–161
Credit, farm, 464–475
Credit:
  based on crop production, 14
  based on land, 14
  based on livestock, 14
  basis of, 467–468
  cost of, 474–475

Credit (*Cont.*):
  defined, 397, 464
  distinguishing between debit and, 397–398
  sources of, 469–474
  types needed, 468
  use of, principles involved in, 464–467
Cropping system:
  development of, 118–119
  standard forty-acre farm, 128
Crops:
  area equivalent, 171
  complementary relations, 58
  disposition, probable, on forty-acre farm, 135
  gross value as basis for selecting, 66
  history of farm, 284
  labor, utilization of, 220
  livestock and, complementary relations, 58
  material requirements for, 84
  net return as basis for selecting, 66–72
  normal yields and prices for, determining, 116
  probable production, projecting, 120–121
  production tasks, 216
  relation of choice of, to farm earnings, 107
  relation of yields to farm earnings, 107
  rotation, 241
    standard forty-acre farm, 131
  selection of, 52–53
Cultivators, selection of, 300–301
Custom work, power selection factor, 315

D

Davenport, E., *The Farm*, 279–284
Daybook, use of, 396, 398–399
Debit:
  defined, 397
  distinguishing between credit and, 397–398
Deed to farm, legal aspects, 294–295
Demand, changes in, 157
  reason for diversification, 161
Department of Agriculture, 31, 197, 363
Dewey Decimal System, 400, 402–403
Diminishing productivity, law of, 203–204
Diminishing returns, law of, 250, 251–252
Direct comparison method, farm enterprise selection and combination by, 97–112
  analysis, method of, 100–110
  criticisms of, 110–112
  information needed, basic, 98–99
    method used in collecting, 99–100
Disease, plant and animal agricultural risk, 12–13
Diversification:
  comparative advantage, law of, 152–154
  defined and described, 151–152
  degrees of, 152
  farming, 151–166
  measuring, 179–180
  production, as self-insurance, 13
  reasons for, 158–161
  returns and, 161–166
  risk reduced by, 268
Diversity index, 180
Doane, D. Howard, *Recent Developments in Professional Farm Management in the U. S.*, 358
Doane Consulting Service, 358–359
Drought, agricultural risk, 12

E

Earnings, farm, *see* Financial returns
Economic rent, relation between contract and, 273–275
Economic reports:
  accuracy, 371–372
  aid to management, 362–374
  intention-to-plant, 367–368
  nature of, 363–367
  outlook, 368–371
  pig crop, 368
  used how, 373–374
Education of farm operators, 14–15
Efficiency:
  enterprise, 195
  factors, farm enterprises, 104
  measuring, 184–185
Elliott, F. F., 35
  Adjusting Hog Production to Market Demand, 228
Ely, R. T., 33
Ely, R. T., and Morehouse, E. W., *Elements of Land Economics*, 286
England, farm management in, 41–42
Enterprises, farm:
  allocation of farm resources:
    problem of, 72–76
    rules for, 76–80

Enterprises, farm (*Cont.*):
  combination of:
    direct comparison method, 97–112
    general principles, 66–80
    standard, 114–125
      using, 127–150
    substitution method, 81–96
  relation between, factor in production, 55–59
  selecting, methods of, 66–72
Entrepreneur, farmer as, 22, 26–27, 51, 252
Entries, journal:
  posting, 407–416
  types of, 405
Equi-marginal returns, theory of, 77–78
  method of substitution and, 95–96
Equipment, initial cost, power selection factor, 315
Europe, development of farm management in, 28–37
Expenses, farm, 87, 91, 93
Experiments:
  controlled, 198–199
  practical, 199–203
Extension service, farm, 360, 367
External accounts, 395
Ezekiel, Mordecai, 35, 255, 373
  Practices Responsible for Variations in Physical Requirements and Economic Costs of Milk Production on Wisconsin Dairy Farms, 224

F

Family:
  earnings, calculating, 187
  farm, concept of, 3–6
Farm:
  accounts, 394–428
    Columnar method, 420–426
    defined and described, 376–377
    function of, 391–392, 395–396
    nature of simple, 394–401
    results, analysis of, 426–428
    set of simple, 402–420
  acquisition, 272–295
    economic factors affecting, 273–277
    legal aspects, 292–295
  analysis of actual, standard system, 139–142
  appraisal, 288–292
    blank for, 289–290
  assessed value, as measure of size, 169
  bureaus, 360
Farm (*Cont.*):
  capital earnings, calculating, 186
  concept of, 2–6
  corporation, defined, 351
  credit, *see* Credit
  defined, 2
  diversified, 151–166
  enlargement through specialization, 154
  enterprises:
    allocation of farm resources:
      problem of, 72–76
      rules for, 76–80
    combination of:
      direct comparison method, 97–112
      general principles, 66–80
      standard, 114–125
        using, 127–150
      substitution method, 81–96
    relation between, factor in production, 55–59
    selecting, methods of, 66–72
  family:
    concept of, 3–6
    earnings, calculating, 187
  implements needed on standard, 129–130
  insurance, 13
  layout, 233–248
    developing a good, 244–248
    effect on use of factors of production, 237–243
    factor affecting choice of farm, 285
    factors affecting, 233–235
    ideal, 235–236
    planning, 243–244
    power selection factor, 309–310
  location of, factor affecting choice of, 286–287
  management:
    beginnings in, 28–31
    concepts of, various, 19–22
    defined, 19–20, 26–27
    development, 28–47
    economic reports as aids to, 362–374
    farmer as manager, 321–323
    functions of, 318–321
    in England, 41–42
    in European countries, 28–37
    in Germany, 37–40
    in Italy, 46–47
    in Russia, 42–46
    in Switzerland, 40–41
    in United States, 28–37
    industrial management compared, 323–324
    measures of efficiency, 103

Farm (*Cont.*):
    nature of, 19–27, 318–326
    new forms of, 350–360
    professional service, 358–359
    "Route Method" of study, 30–31
    scientific, 324–326
    size of farm affecting, 264–265
    social sciences and, 25–26
    "Survey Method" of, 33
    tasks, 217
    technical services and, 22–24
  market value, as measure of size, 169
  measuring:
    size of business, 167–170
    success of business, 185–189
  operation, credit for, 464–475
  operators, professional training, 14–15
  organization:
    combination of factors of production, 60–63
    defined and described, 50–51
    flexibility, 62–63
    market connections and information, 63
    measures of efficiency, 103
    problems of, 50–64
    records and accounts, system, 63–64
    selection of lines of production, 52–60
    "Unit System" of, 62
  original price paid, as measure of size, 169
  physical output, as measure of size, 168–169
  practices:
    capital, utilization of, 222–225
    diminishing productivity, law of, 203–204
    economics of, 195–231
    experimentation:
      controlled, 198–199
      practical, 199–203
    inputs, most profitable combination, determining, 204–212
    labor, utilization of, 219–222
    land, use of, 225–226
    scientific study of, 197–198
    tasks, classification, 215–217
    time or timeliness as related to, 226–231
    types of, 195–196
    variation in, causes for, 196–197
  products, standardization, 10–11
  records, 376–392
    breeding, 391–392
    defined and described, 376–377
    feed, 383–386

Farm (*Cont.*):
    field, 388
    function of, 391–392
    kinds of, 377–391
    labor, 381–383
    materials, 388
    miscellaneous, 388–391
    production, 386–388
    property, 377–381
  reorganization, 89, 92, 142–145
  selection, 272–295
    appraisal, 288–292
    physical factors affecting, 277–287
    purchase or rental, personal considerations affecting, 287–288
  self-sufficiency, 1, 6–8, 15–16
  size of, 250–271
    area and net returns, relation between, 253–256
    buying and selling, advantages in, 268–269
    financing, economies in, 269–270
    measuring, 251–253
    power selection factor, 306–308
    production, use of factors of, 256–265
    products, economy in use of, 265–267
    risk, reduction of, 267–268
    selection, 295
  specialized, 151–166
  standard forty-acre, 127–139
    cropping system, 128
    feeds, disposition, 137–138
    financial returns, 138–139
    labor, utilization of, 130–133
    livestock production, 136–137
    prices, 135
    resources, 127–128
    yield and production, 133–134
  tasks:
    classification, 215–217
    factor in power selection, 305–306
    specific, relation to income, 217–219
  unit of organization, 2, 10
Farm Credit Act of 1933, 470
Farmer:
  age of, power selection factor, 314
  as businessman, 50
  as entrepreneur, 22, 26–27, 51, 252
  as manager, 321–323
  control over production, limitation, 11–12
  differential nature of management, 318–326

Farmer (*Cont.*):
  education, 14–15
  professional training, 14–15
  tenant, 10, 321
Farming:
  chain, 354–355, 360
  Civil War, before and after, 1
  colonial, 1
  corporation, 350–354, 360
  diversified, 151–166
  group, 355–359, 360
  industry of small independent units, 10
  management and ownership, function of, 9–10
  nature of modern, 1–17
  quasi-capitalistic, 2
  risks, reduction of, 12–14
  specialized, 151–166
Federal Reserve System, 471
Feeds:
  disposition, standard forty-acre farm, 137–138
  record, 383–386
  requirements for livestock, 85
  self-sufficiency of farm, 8
Fences:
  relation of kind to land occupied by, 238
  rods for a forty-acre field of different lengths, 243
  rods per acre for square field, 242
  size of farm, economy determined, 257–258
Fertilizer:
  effect on yield of potatoes, 201
  effect on yield of seed cotton, 200
  requirements for standard forty-acre farm, 135
  self-sufficiency of farm, 7–8
  used on actual farm, 143
Field records, 388
Financial returns:
  analysis of actual farm, 141
  diversification and, 161–166
  farm capital earnings, calculating, 186
  from cotton when production increased by fertilizer, 73
  index of, per $100 feed to different classes of livestock, 105
  investment, rate of return on, determining, 188–189
  net, per acre from a Wisconsin farm, 68
  per man hour of cotton and corn, 71
  reason for diversfication, 160
  relation of amount of livestock to farm earnings, 108
Financial returns (*Cont.*):
  relation of choice of crops to farm earnings, 107
  relation of crop yield to farm earnings, 107
  relation of livestock returns to farm earnings, 107
  relation of power, machinery, equipment, and building expense to farm earnings, 109
  relation of size of business to farm earnings, 108
  relation of work accomplished to farm earnings, 109
  reorganization plan number 2, 94
  selected California crops from 20 acres, 67
  standard forty-acre farm, 138–139
  variation in, causes, 256
Financial statements, 87, 148, 192–193
  inventory and, 403–404
Financing:
  agricultural production, 14
  economies in, size of farm, 269–270
Food, self-sufficiency of farm, 6
Forster, G. W., *Land Prices and Speculation in the Bluegrass Region of Kentucky*, 275
Frauendorfer, Sigmund von, 39
Fuel, self-sufficiency of farm, 6
Funds available, factor affecting farm acquisition, 276–277
Funk, W. C., *Value to Farm Families of Food, Fuel, and Use of House*, 6

G

Gain accounts, 395
Germany, farm management in, 37–40
Gilbert, C. W.:
  Economic Study of Tractors on New York Farms, 308, 315
  Farm Tractors in Minnesota, 313
Good will, developing in labor, 335–336
Gray, L. C., 34
  Introduction to Agricultural Economics, 19, 26
Gray, L. C., and Lloyd, O. G., *Farm Land Values in Iowa*, 275
Gray, L. C., and Turner, Howard A., *The Farm Lease Contract*, 442
Gross value, basis for selecting crops, 66
Group farming, 355–359, 360

Gustafson, A. F., *Soil Moisture and Tillage of Corn*, 225

H

Hail, agricultural risk, 12
Harvesting:
  labor, utilization of, 219–220, 220–222
  tasks, 216
Hawthorne, H. W., *The Family Living from the Farm*, 6
Hays, Willett M., "Route Method" of farm management study, 30–31
Highways, affecting farm layout, 234, 235–236
Holding accounts, 395
Holmes, L. C.:
  Economics of Farm Organization and Management, 20
  Farm Management, 40–41
Horner, J. T., *Government Activities Prior to 1913*, 30
Horses:
  advantages over tractor, 315–316
  size of farm determining, 262–264
  tractor power and, cost of, 310
Houston, David, Secretary of Agriculture, 34
Hunt, T. F., management studies of, 31

I

Implements:
  capital investment in, 10
  needed on standard farms, 129–130
  supplementary relations, 57
Improvements, condition of, affecting choice of farm, 285–286
Income, *see also* Financial return
  cash, calculating, 187–188
  labor:
    average, 254
    calculating, 186
  net farm:
    calculating, 185–186
    determining, 121–124
    measuring, 167
  relation of specific tasks to, 217–219
  statement, 143
Industrial management and farm management compared, 323–324
Initiative, developing in labor, 335–336
Input-output relations, farm enterprises, 104
Inputs, most profitable combination, determining, 204–212
Insect pests, agricultural risk, 12
Insurance, farm, 13
Intention-to-plant reports, 367–368
Interest, current rate of, factor affecting farm acquisition, 275–276
Intermediate:
  credit, 468
    cost of, 474–475
    sources of, 469, 471–472
  products, 159
    size of farm determining, 266–267
Inventory and financial statement, 403–404
Investment:
  estimated for standard farms, 130
  rate of return on, determining, 188–189
Italy, farm management in, 46–47

J

Journal:
  mixed columnar, 422–426
  posting the entries, 407–416
  use of, 396, 399
Journalizing:
  assets, liabilities, net worth, 404–406
  defined, 397
Juve, O. A., *Labor and Material Requirements for Field Crops*, 220

K

King, W. I., *Income of the United States*, 8
Kirkpatrick, E. L., *The Farmer's Standard of Living*, 6

L

Labor:
  adjustments, day-to-day, making, 339–340
  affecting selection of machinery, 298
  average employed during year, measure of labor, 174–175
  competition for, 56
  developing initiative, good will, cooperation, respect, 335–336
  distribution, 132, 133
    standard forty-acre farm, 132–133
  farm layout effect on, 239–243
  hired, 7

- Labor (*Cont.*):
  - incomes:
    - average, 254
    - calculating, 186
  - input for enterprises, 116
  - management, 328–340
  - measures of, 174–177
  - planning day-to-day utilization of, 336–339
  - record, 381–383
  - requirements:
    - determination, 119
    - for livestock, 85
    - per acre of crops, normal, 83
  - selection, 329–330
  - self-sufficiency of farm, 6–7
  - size of farm determining, 260–262
  - social life, providing, 340
  - supervision, 330–335
  - supplementary relations, 57
  - supply, power selection factor, 313–314
  - training, 330–335
  - utilization of:
    - effect of methods on, 219–222
    - forty-acre farm, 130–133
- Land:
  - competition for, 56
  - credit based on, 14
  - distribution of area, factor affecting choice of farm, 277
  - farm layout effect on, 237–239
  - power effect on, 312
  - size of farm affecting use, 264
  - supplementary relations, 57
  - use of, relation of methods to, 225–226
- Land Bank Commissioner, 472
- Laur, Ernst, 40
- Law of:
  - comparative advantage, 152–154
  - diminishing productivity, 203–204
  - diminishing returns, 250, 251–252
- Layout, farm, 233–248
  - developing a good, 244–248
  - effect on use of factors of production, 237–243
  - factor affecting choice of farm, 285
  - factors affecting, 233–235
  - ideal, 235–236
  - planning, 243–244
  - power selection factor, 309–310
- Lease, written:
  - advantages and disadvantages, 452–455
  - nature and preparation, 440–452
- Least-cost analysis, determining input, 206–210
- Ledger:
  - closing the accounts, 418–420
- Ledger (*Cont.*):
  - use of, 396, 400
- Legal aspects of buying farm, 292–295
- Leisure time, reason for specialization, 157
- Liabilities:
  - defined, 397
  - journalizing, 404–406
- Livermore, K. C., *Agricultural Survey, An*, 33
- Livestock:
  - capital investment in, 10
  - credit based on, 14
  - crop and, complementary relations, 58
  - determining for standard system, 121
  - disposition, probable, on forty-acre farm, 135
  - feed, material, and labor requirements for, 85
  - feeds to, disposition on standard forty-acre farm, 137–138
  - measures of, 172–174
  - production:
    - standard forty-acre farm, 136–137
    - tasks, 216
  - relation of amount of, to farm earnings, 108
  - relation of returns from, to farm earnings, 107
  - self-sufficiency of farm, 8
  - suggested for forty-acre farm, 136
- Lloyd, O. G., and Gray, L. C., *Farm Land Values in Iowa*, 275
- Location of farm, factor affecting choice of farm, 286–287
- Long-term credit, 468
  - cost of, 475
  - sources, 469, 472–474
- Loss accounts, 395

M

- Machinery:
  - capacity, measure of, 177–179
  - capital investment in, 10
  - combine vs. binder and header, 301–305
  - cultivators, selection of, 300–301
  - harvesting, labor saving, 220
  - introduction, 1
  - relation of, to farm earnings, 109
  - selection, 297–305
    - factors affecting, 297–299
    - how to select, 299–305
  - size of farm determining, 256–257
  - specialization affected by, 156
  - supplementary relations, 57

Maine Board of Agriculture, 30
Management, farm:
  beginnings in, 28–31
  concepts of, various, 19–22
  defined, 19–20, 26–27
  development, 28–47
    in European countries, 37–47
    in United States, 28–37
  economic reports as aids to, 362–374
  farmer as manager, 321–323
  functions of, 318–321
  in England, 41–42
  in Germany, 37–40
  in Italy, 46–47
  in Russia, 42–46
  in Switzerland, 40–41
  industrial management compared, 323–324
  measures of efficiency, 103
  nature of, 19–27, 318–326
  new forms of, 350–360
  ownership and:
    control over production, 11–12
    function of, 9–10
    separate functions, 2
  professional service, 358–359
  "Route Method" of study, 30–31
  scientific, 324–326
  size of farm affecting, 264–265
  social sciences and, 25–26
  "Survey Method" of, 33
  tasks, 217
  technical services and, 22–24
Manure, *see* Fertilizer
Marginal analysis, determining input, 211–212
Market:
  conditions, diversification as protection against change in, 159
  connections, 63
  demand, factor in production, 59–60
  distance from, factor in production, 60
  information, 63
  specialization develops, 154–155
  value, as measure of farm size, 169
Marketing tasks, 216
Materials:
  purchasing, 345–348
  record, 388
McNall, P. E., *Practices Responsible for Variations in Physical Requirements and Economic Costs of Milk Production on Wisconsin Dairy Farms*, 224
Measurement, units of, 167–193
Measuring:
  capacity, 184–185
  diversification, 179–180
  efficiency, 184–185
  farm organization and management efficiency, 103
  production factors, 170–179
    labor, 174–177
    livestock, 172–174
    machine capacity, 177–179
    productive area, 170–172
  productiveness, 180–183
  size of business, 167–170
  size of farm, 251–253
  success of farm business, 185–189
    criticism of, 189–193
Minnesota Experimental Station, 30
Morehouse, E. W., and Ely, R. T., *Elements of Land Economics*, 286
Moorhouse, L. A.:
  Labor and Material Requirements for Field Crops, 220
  Management of the Farm, The, 20
Morrison, F. B., *Practices Responsible for Variations in Physical Requirements and Economic Costs of Milk Production on Wisconsin Dairy Farms*, 224
Mosier, J. G., *Soil Moisture and Tillage of Corn*, 225
Myers, W. J., *Economic Study of Farm Layout*, 240–241, 243–244, 244–248

N

National Fertilizer Association, 222
Net income:
  calculating, 185–186
  determining, 121–124
  measuring, 167
Net returns:
  area and, relation between, 253–256
  basis of selecting farm enterprises, 66–72
Net worth, 404
  journalizing, 404–406
  rate of return on, determining, 189
Niccoli, Vittorio, 46
Nodland, *Annual Report of the Southwestern Minnesota Farm Management Service*, 106
Noncompeting enterprises, factor in production, 55, 56–57

North Carolina Agricultural Experiment Station, 223
Numbering of accounts, 400–401

O

Observation method, determining fairness of cash rental contract, 457–458
Office of Farm Management, 32–35
Operators, *see* Farmers
Organization, farm, *see also* Management, farm
  combination of factors of production, 60–63
  defined and described, 50–51
  farm unit of, 2, 10
  flexibility, 62–63
  market connections and information, 63
  measures of efficiency, 103
  problems of, 50–64
  records and accounts, system, 63–64
  selection of lines of production, 52–60
  "Unit System" of, 62
Orwin, C. S., *Cutting the Farmer's Costs*, 41–42
Outlook reports, 368–371
Ownership and management:
  control over production, 11–12
  function of, 9–10
  separate functions, 2

P

Patent Office, Agricultural Section cost studies, 28–29
Personal factors in production, 60
Physical conditions, factor in production, 55
Physical factors affecting choice of farm, 277–287
Physical output, volume of, measuring, 168
Pig Crop Report of 1937, 368
Plantation, characteristics, 3, 354
Plowing, depth of, effect, 226
Pohl, 38
Pond, George A.:
  Annual Report of the Southwestern Minnesota Farm Management Service, 106
  Farm Organization in Southwestern Minnesota, 82
  Relation of Variations in the Human Factors to Financial Returns in Farming, 217
Post Office Department, 363
Posting:
  defined, 397
  journal entries, 407–416
Power, farm, 10
  cost of, 310–312
  relation of, to farm earnings, 109
  selection, 305–316
Practical experimentation, 199–203
Practices, farm:
  capital, utilization of, 222–225
  diminishing productivity, law of, 203–204
  economics of, 195–231
  experimentation:
    controlled, 198–199
    practical, 199–203
  inputs, most profitable combination, determining, 204–212
  labor, utilization of, 219–222
  land, use of, 225–226
  scientific study of, 197–198
  tasks:
    classification, 215–217
    specific, relation to income, 217–219
  time or timeliness as related to, 226–231
  types of, 195–196
  variation in, causes for, 196–197
Prices:
  anticipated, influence on production, 16–17
  changes of, diversification as protection against, 159
  market demand reflected in, factor in production, 59–60
  normal, determining for standard enterprise combinations, 116
  of farm, 274–275
    original, as measure of size, 169
  standard forty-acre farm, 135
  used for all combinations, 84
Production:
  analysis of actual farm, 140–141
  anticipated prices, influence on, 16–17
  control over, limitation, 11–12
  costs, influence on, 16–17
  diminishing productivity, law of, 203–204
  diversification, as self-insurance, 13
  economy in use of factors of, size of farm, 256–265
  factors of, 55–60
    combination of, 60–63
  farm layout effect on use of factors of, 237–243
  financing, 14

Production (*Cont.*):
  livestock, standard forty-acre farm, 136–137
  measuring factors of, 170–179
  measuring productiveness, 180–183
  probable, on standard forty-acre farm, 135
  reason for specialization, 155–156
  record, 386–388
  selection of lines of, 52–60
  stages in, 203
  standard forty-acre farm, 133–134
  tasks, classification, 215–217
  trend, determining for standard enterprise combinations, 116
  units of resources, 77, 78, 79
Production Credit Commissioner, 471
Productive area, measures of, 170–172
Productive work unit, as measure of labor, 175–176
Products, farm:
  economy in use of, size of farm, 265–267
  standardization, 10–11
Professional farm management service, 358–359
Profits, calculating, 187
Property records, 377–381
Purchasing:
  farms, 274–275
    personal considerations affecting, 287–288
  legal aspects of buying a farm, 292–295
  supplies and materials, 345–348

R

Railways, affecting farm layout, 234
Rainfall, agricultural risk, 12
Ranch, characteristics, 3
Rate:
  return on investment, determining, 188–189
  return on net worth, determining, 189
  turnover, determining, 188
Records, farm, 376–392
  breeding, 391–392
  defined and described, 376–377
  feed, 383–386
  field, 388
  function of, 391–392
  labor, 381–383
  materials, 388
  miscellaneous, 388–391
  production, 386–388
  property, 377–381
  system of, 63–64
Rental:
  contract and economic, relation between, 273–275
  contracts:
    cash, 431, 456–462
      fair and reasonable, determining, 457–462
    equitable, making, 434–440
    lease, written:
      advantages and disadvantages, 452–455
      nature and preparation, 440–452
    share, 430–455
    types of, 430–433
      factors governing, 433–434
  of farm, personal considerations affecting, 287–288
Reorganization, farm, 89, 92, 142–145
Repair and replacement service, affecting selection of machinery, 298–299
Reports:
  accuracy of, 371–372
  aid to management, 362–374
  daily labor, form, 382
  intention-to-plant, 367–368
  nature of, 363–367
  outlook, 368–371
  pig crop, 368
  used how, 373–374
Resources, farm:
  allocating, problem of, 72–76
  analysis of actual farm, 139–140
  factor in production, 55
  standard forty-acre farm, 127–128
  units used in production, 77, 78, 79
Respect, developing in labor, 335–336
Returns, *see* Financial returns
Risks:
  factor in production, 60
  reduction of, 12–14
    by diversification, 158–159
    size of farm determining, 267–268
Rotation of crops, 241
  standard forty-acre farm, 131
"Route Method" of farm management study, 30–31
Routine, result of specialization, 154
Rules:
  allocation of resources to farm enterprises, 76–80
  training of labor, 332–335
Russia, farm management in, 42–46

S

Sale, terms of, legal aspects, 292–294
Schwantes, 313

Science, farm management as, 20–21
Scientific management, 324–325
Seasonality, reason for diversification, 158
Seed:
  requirements for forty-acre farm, 135
  self-sufficiency of farm, 7
  testing, as self-insurance, 14
Selection of:
  farm, 272–295
    appraisal, 288–292
    physical factors affecting, 277–287
    purchase or rental, personal considerations affecting, 287–288
  labor, 329–330
  machinery, 297–305
    factors affecting, 297–299
    how to select, 299–305
  power, 305–316
Self-sufficiency of farm, 1, 6–8, 15–16
Selling, advantages in, size of farm, 268–269
Sewell, M. C., *Tillage*, 226
Share rental contract, 430–455
Shelter, self-sufficiency of farm, 6
Short-term credit, 468
  cost of, 474
  sources of, 469, 470–471
Single crop index, measuring productiveness, 181
Size of farm, 250–271
  affecting selection of machinery, 298
  area and net returns, relation between, 253–256
  buying and selling, advantages in, 268–269
  financing, economies in, 269–270
  measuring, 167–170, 251–253
  power selection factor, 306–308
  production, use of factors of, 256–265
  products, economy in use of, 265–267
  risk, reduction of, 267–268
  selection, 295
Sliding-scale method, determining fairness of cash rental contract, 458–460
Social life, providing, 340
Social sciences, farm management and, 25–26
Soil:
  affecting farm layout, 234
  affecting selection of machinery, 298
  character of, 154
Soil (*Cont.*):
  fertility, factor affecting choice of farm, 278–284
  improvement of fertility, reason for diversification, 160
  survey, 284
  types, summary of, 280–283
Soviet farms, 42–46
Specialization:
  comparative advantage, law of, 152–154
  defined and described, 151–152
  degrees of, 152
  farming, 151–166
  reasons for, 154–158
Spillman, W. J.:
  Director of Office of Farm Management, 32, 34
  farm management studies, 31
  Model Farm, A, 32
  What Is Farm Management, 20
Springfield Plan, farm purchase, 292–293
Stalin, Joseph, 43
Standard combination of farm enterprises, 114–125
  analysis of an actual farm, 139–142
  analysis of data, 115–117
  criticism of method, 145–150
  information needed, 114–115
  standards, development of, 117–124
  usefulness of standards, 124–125
  using the standard systems, 127–150
Standard forty-acre farm, 127–139
  cropping system, 128
  feeds, disposition, 137–138
  financial returns, 138–139
  labor, utilization of, 130–133
  livestock production, 136–137
  prices, 135
  resources, 127–128
  yield and production, 133–134
Standardization of farm products, 10–11
Statements, inventory and financial, 403–404
Stine, O. C., 34
Stippler, H., *Philosophy of Aereboe*, 38
Substitution method, farm enterprise selection and combination by, 81–96
  present organization of farm, 84–87
  suggested changes, 88–95
  theory of equi-marginal returns and, 95–96
Success, measuring, 185–189

Success (*Cont.*):
  criticism of, 189–193
Supervision of:
  labor, 330–335
  working capital, 343–345
Supplementary enterprises, factor in production, 55, 56–57
Supplies, purchasing, 345–348
"Survey Method" of:
  collecting information, 99–100
  farm management, 33
Switzerland, farm management in, 40–41

T

Tapp, J. W., *Farm Organization in Southwestern Minnesota,* 82
Tariff policy, change in, reason for specialization, 157
Tasks, farm:
  assignment, 330–335
  classification, 215–217
  factor in power selection, 305–306
  specific, relation to income, 217–219
Taxes:
  affecting farm acquisition, 276
  legal aspects of farm purchase, 295
Taylor, Henry C.:
  Agricultural Economics, 33
  Director of Office of Farm Management, 34
  Outlines of Agricultural Economics, 62
  Practical Farm Economics, 19
  research in farm management, 33–34
Technical services, farm management and, 22–24
Technical skills, improvement in, 159–160
Tenant farmers, 10, 321
Terms of sale, farm, legal aspects, 292–294
Thaer, Albrecht D., 37
Thuenen, Heinrich von, 37
Time as related to farm practices, 226–231
Title to farm, legal aspects of purchase, 294–295
Toben, *Annual Report of the Southwestern Minnesota Farm Management Service,* 106
Tolley, H. R., 35
  Farm Tractors in Minnesota, 313
  Recent Developments in Research Method and Procedure in Agricultural Economics, 35–37
Topography:
  affecting choice of farm, 277–278
  affecting farm layout, 233–234
  affecting selection of machinery, 298
  importance of, 154
  power selection factor, 308–309
Tractor vs. horse power, 305–316
Training:
  farm operators, professional, 14–15
  labor, 330–335
Transaction, defined, 397
Transportation:
  cost, increase in, reason for diversification, 160–161
  facilities available, factor in production, 60
  specialization encouraged by, 158
Trial balance, 416–418
Turner, Howard A., and Gray, L. C., *The Farm Lease Contract,* 442
Turnover, rate of, determining, 188

U

"Unit System" of farm organization, 62
United States, development of farm management in, 28–37

V

Von der Goltz, 38

W

Wages, measure of labor, 174
Wallace, H. C., 363
Waller, A. G., *Farm Tractors in Minnesota,* 313
Warren, G. F.:
  Agricultural Survey, An, 33
  Farm Management, 20, 26, 261, 278
  farm management studies, 32–33
Water supply:
  affecting choice of farm, 286
  affecting farm layout, 234
Weather conditions:
  agricultural risk, 12, 14
  diversification reducing loss by, 158
  production control limitation, 12
Weighted index, measuring productiveness, 182–183
Wells, Oris V., 371
Wilcox, W. W., *Relation of Variations in the Human Factors to Financial Returns in Farming,* 217

Wilson, James, Secretary of Agriculture, 31–32
Work:
  simplification, 325–326
  unit, productive, as measure of labor, 175–176
Working, E. J., *Crop Yield Index Numbers*, 182
Working capital:
  adjustments in, 342–343
  defined, 341–342
  management, 341–348
  planning use for the year, 342
  supervising, 343–345
Works Progress Administration, *Changes in Farm Power and Equipment*, 314

Y

Yields:
  analysis of actual farm, 140–141
  composite index of, 182
  normal, determining for standard enterprise combinations, 116
  relation of, to farm earnings, 107
  standard forty-acre farm, 133–134
  used for all combinations, 84
Young, Arthur, 41
Young, E. C., *Work Simplification News Letter No. 9*, 325

X

Zintheo, C. J., *Corn Harvesting Machinery*, 220